BLM LIBRARY
88074652

Colorado River Basin Salinity Control Program
Federal Accomplishments Report for Fiscal Year 2011

Presented to

Colorado River Basin Salinity Control Advisory Council

by

United States Department of Agriculture
Environmental Protection Agency
U.S. Fish and Wildlife Service
U.S. Geological Survey
Bureau of Land Management
Bureau of Reclamation

October 2011

BLM Library
Denver Federal Center
Bldg. 50, OC-521
P.O. Box 25047
Denver, CO 80225

#1129014967 ID: 880746652

TD
427
.S24
C456
2011

Colorado River Basin Salinity Control Program
Federal Accomplishments Report for Fiscal Year 2011
Acronyms and Abbreviations

Advisory Council	**Colorado River Basin Salinity Control Advisory Council**
ASCS	**Agricultural Stabilization and Conservation Service**
Basinwide Program	**Basinwide Salinity Control Program**
BLM	**Bureau of Land Management**
BSP	**Basin States Program**
CAP	**Central Arizona Project**
CRBSCP	**Colorado River Basin Salinity Control Program**
CRSS	**Colorado River Simulation System**
EPA	**Environmental Protection Agency**
EQIP	**Environmental Quality Incentives Program**
FAIRA	**Federal Agricultural Improvement and Reform Act**
FOA	**Funding Opportunity Announcement**
Forum	**Colorado River Basin Salinity Control Forum**
FSRIA	**Farm Security and Rural Investment Act**
FY	**Fiscal Year**
GGNCA	**Gunnison Gorge National Conservation Area**
GIS	**Geographic Information System**
HDB	**Hydrologic Date Base**
NCA	**National Conservation Area**
NIWQP	**National Irrigation Water Quality Program**
NRCS	**Natural Resources Conservation Service**
Reclamation	**Bureau of Reclamation**
RMP	**Resource Management Plan**
Service	**U.S. Fish and Wildlife Service**
TDS	**Total Dissolved Solids**
TMS	**Technical Modeling Subcommittee**
USDA	**United States Department of Agriculture**
USGS	**U.S. Geological Survey**
UVWUA	**Uncompahgre Valley Water Users Association**
Work Group	**Colorado River Basin Salinity Control Forum's Work Group**

Table of Contents

USDA Natural Resources Conservation Service 1

EPA Update 9

Fish and Wildlife Service 13

U.S. Geological Survey 19

Bureau of Land Management 41

Bureau of Reclamation 67

List of Tables

Table 1 – Active Salinity Control Projects 3

Table 2 – USDA Salinity Control Unit Summary Thru 2010 7

Table 3 – Basin States Adoption of Salinity Standards & Plan of Implementation Updates 11

Table 4 – Arizona Strip Accomplishments and Tons of Salt Retained in FY 2010 45

Table 5 – ARRA Funding 71

Table 6 – Paradox Well Injection Evaluation 77

List of Figures

Figure 1 – Expenditures and Investigations 4

Figure 2 – Map showing distribution of additional water quality monitoring sites in the UCRB 26

Figure 3 – 1993 and 2008 Montrose Arroyo Study Area 32

Figure 4 – Pah Tempe Spring, Washington County, Utah 33

Figure 5 – Virgin River in Timpoweep Canyon immediately downstream of Pah Tempe Springs 34

Figure 6 – U.S. Geological Survey water-quality monitoring site in Birch Springs Draw, Utah 34

Figure 7 – Upper Colorado River basins initially included in the study (green areas are agricultural basins and brown areas are natural basins).....35

Figure 8 – Acoustic Doppler Current Profiler discharge measurement on the Colorado River above Kane Creek.....37

Figure 9 – BLM Funding distribution for salinity control projects.....41

Figure 10 – Flat Top #1 overflow pipe exposed before repair.....44

Figure 11 – 2011 Yellow Creek assessment photo near Stinking Spring (Note salt accumulation on streambanks).....47

Figure 12 – Badger Wash water sampler (near man on left side) and flume setup.....48

Figure 13 – Well inventory Red Cliff study area.....49

Figure 14 – "Monument West KA-6 exclosure, near Thompson Utah".....55

Figure 15 – Graphical illustration of the amount of sediment moving along the ground surface at Swing Arm (in the middle of the play area), the pits (1.3 miles from Swing Arm), and the no-play area.....57

Figure 16 – Heavy equipment removing Russian olives from a Utah railroad right-of-way.....59

USDA Natural Resources Conservation Service
Colorado River Basin Salinity Control Program
Accomplishments for Fiscal Year 2011

The Natural Resource Conservation Service (NRCS) of the United States Department of Agriculture (USDA) conducts Colorado River Basin Salinity Control activities primarily under the authorities of the Environmental Quality Incentives Program (EQIP). EQIP was enacted with passage of PL104-127, Federal Agricultural Improvement Act of 1996, a.k.a. "1996 Farm Bill."
EQIP has been reauthorized twice; by PL 107-171, The Farm Security and Rural Investment Act of 2002, the "2002 Farm Bill" and by PL 110-246, The Food, Conservation, and Energy Act of 2008, the "2008 Farm Bill." The 2008 Farm Bill expires September 30, 2012.

Through EQIP, NRCS offers voluntary technical and financial assistance to agricultural producers, including Native American tribes, to reduce salt mobilization and transport to the Colorado River and its tributaries. Within the eleven approved salinity project areas, producers may be offered additional financial incentives to implement salinity control measures with the primary goal of reducing offsite and downstream damages and to replace wildlife habit impacted as a result of the salinity measures.

In fiscal year (FY) 2011, $17.5 million of appropriated EQIP funding was allocated for financial and technical assistance to agricultural producers in project areas in Colorado, Utah, and Wyoming.

New Projects, Activities, and Investigations

Henrys Fork, Wyoming (formerly known as McKinnon–Lone Tree-Burnt Fork)

Planning is proceeding for the Henrys Fork Project. NRCS conducted an Environmental Assessment (EA) in 2010 and determined that significant impacts to the human environment were likely; consequently the preparation of an Environmental Impact Statement (EIS) began in 2011.

The project area comprises about 306,000 acres in two counties in Wyoming and two counties in Utah of which about 70,000 acres are privately owned and the remainder are Wyoming State lands or federal lands administered by the U.S. Forest Service or the Bureau of Land Management. The project will only address 21,500 acres of irrigated private lands that are predominantly (80 percent) in Wyoming. The proposed treatment alternative would provide technical assistance and financial incentives to landowners who voluntarily choose to implement improved irrigation systems; almost exclusively sprinkler systems. The Plan anticipates that 74% of the irrigated acreage might ultimately be treated, leaving the remaining acreage un-improved flood irrigated. Two public meetings have been held. The NRCS plans to issue of Record of Decision late in 2011 or in 2012.

The draft EIS can be downloaded at:
ftp://ftp-c.sc.egov.usda.gov/WY/PAS/Henrys_Fork_Pre_EIS.pdf or by contacting:

Jeff Lewis
USDA- NRCS
P.O. Box 379
100 East Sage Street
Lyman, WY 82937-0370
307-787-3211

West Blacks Fork, Wyoming

An area of some 28,000 acres of irrigated pasture and hayland near Lyman, Wyoming, contribute salt to the Blacks Fork River, tributary to the Green River. While a large portion of the geology contributes little salt, about 10,000 acres may contribute significant amounts of salt from canal and ditch seepage and deep percolation from water applied to fields.

The Wyoming Water Development Commission provided a significant grant to the Austin-Wall Canal Company resulting in a comprehensive plan to modernize the irrigated areas within their service area. NRCS anticipates that, in the near future, the Company will begin replacing earthen canals with buried pipelines that will provide pressure to operate sprinklers on the irrigated lands. NRCS intends to use its regular EQIP authority to assist producers in the area who want to modernize their irrigation systems. Such systems will provide significant salt control benefits.

San Juan Basin, New Mexico and Arizona

The first phase of the "Shiprock Pilot Project" to control salt was completed by the San Juan River Dineh Water Users, Inc. (SJRDWU, Inc.) in August. A leaky earthen lateral supplied by the Fruitland Canal was replaced with about 8000 feet of buried pipeline that will supply water to 12 Navajo Nation farmers on 168 acres of cropland. The SJRDWU, Inc. completed the construction using their own resources. They also reserved an 8 acre parcel of land and have completed the first years' schedule of practices to develop the parcel as wildlife habitat.

The NRCS has a new field office in Shiprock with a new district conservationist, a civil engineer/salinity coordinator, and a soil conservation technician. Outreach is being conducted to the farmers served by the new pipeline and EQIP applications to improve the irrigation systems have been received. NRCS also conducted soil salinity mapping on some field within the pilot project to establish pre-implementation salt concentrations. As the salt loading is quite high in the San Juan Basin, it is hoped that this pilot project will encourage and accelerate salinity control.

Areas Beyond Current Project Boundaries

NRCS has undertaken to identify salt loading and salinity control from irrigated crop, pasture, and haylands scattered widely throughout the Upper Colorado River Basin but outside of the existing project areas.

With the assistance of the U.S Geological Survey (USGS) and the Bureau of Reclamation, NRCS has been able to make use the SPARROW model to assess salt loads outside of the existing salinity project areas.
In 2011, Colorado and Utah developed EQIP with water quality benefits including alt control outside of the approved project areas but within the Colorado River Basin.

- Colorado, new contracts providing 789 tons
- Utah, new contracts providing 1,390 tons of control.

Monitoring and Evaluation

Project offices continue to monitor and evaluate the effectiveness and quantity of salinity control, wildlife habitat, and economic performance replacement in order to improve overall performance and

management of the program. Generally, the program continues to function effectively and economically, though the overall cost per ton of salt control continues to rise in some areas. It is also noted that additional efforts are needed to identify and implement valuable, low-maintenance, sustainable wildlife habitat replacement. The individual Monitoring and Evaluation reports for FY 2010 for each project can be found on the world-wide-web at http://www.usbr.gov/uc/progact/salinity/index.html

Status of Implementation

USDA-NRCS is providing technical and financial assistance to landowners and operators to implement on-farm salinity control measures in nine approved project areas in three Upper Basin states.

Table 1 – Active Salinity Control Projects

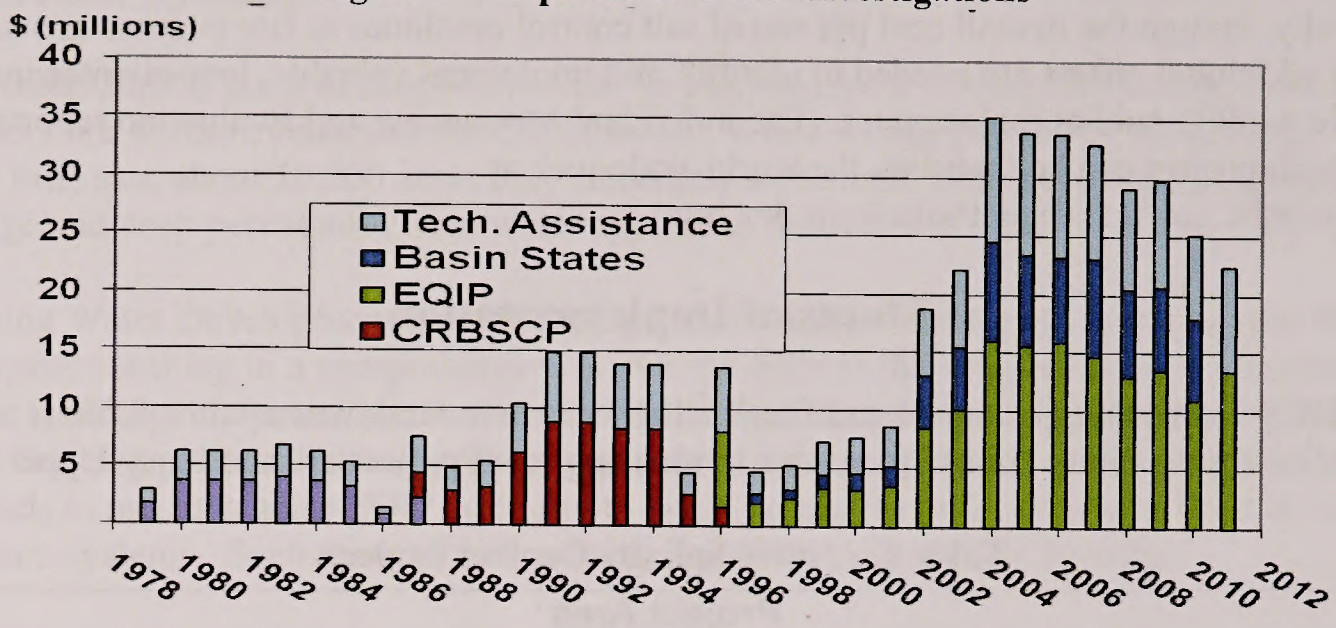
Project Area			
State	**Project**	**(Potential Irrigated Acres)**	**USDA Servicing Office**
Colorado	Grand Valley	50,000	Grand Junction
	Lower Gunnison River	171,000	Delta and Montrose
	McElmo Creek	29,000	Cortez
	Mancos Valley	11,700	Cortez
	Silt	7,400	Glenwood Springs
Utah	Uinta Basin	226,000	Roosevelt, Vernal,
	Price/San Rafael Rivers	66,000	Price, Castle Dale
	Muddy Creek	6,000	Castle Dale
	Manila-Washam	8,000	Vernal
	Green River	2,600	Price
Wyoming	Big Sandy River	18,000	Farson
	Total	595,700	

Existing Projects

Progress in implementing the various projects is controlled primarily by annual appropriations, supplemented with funds from the Basin States Parallel Program. From 1987 through 1995, the Colorado River Basin Salinity Control Program (CRBSCP) received dedicated annual funding. The Agricultural Conservation Program (ACP) administered by the Agricultural Stabilization and Conservation Service (ASCS) provided cost-share assistance to land users through long-term agreements. Technical assistance to land users was provided by the Soil Conservation Service. In 1995, Public Law 103-354 authorized the reorganization of several agencies of USDA. The ASCS was reorganized as the Farm Service Agency. The SCS was reorganized as the NRCS. Financial administration of the CRBSCP was transferred to the new NRCS.

The Federal Agricultural Improvement and Reform Act (FAIRA) of 1996 (Public Law 104-127) combined four existing programs including the CRBSCP into the newly authorized EQIP. In FY 1997, Reclamation began on-farm cost sharing from the Basin States funds that would parallel and supplement the EQIP. For every $1 of USDA funds allocated to salinity control in the authorized project areas, approximately 43 cents is made available from Reclamation's Basin Funds account for additional financial and technical assistance.

Figure 1 – Expenditures and Investigations



In 2011, about $23M was directed towards salinity control measures, plans, and investigations in Colorado, Utah, and Wyoming. These funds were the combination of EQIP; cost share from the Basin States Parallel Program; and expenditures for investigations, contract servicing, and monitoring and evaluation.

Grand Valley, Colorado

Implementation has been underway in this unit since 1979.

In 2010, a detailed status inventory report was compiled from field visits and observations. The report indicates that at least 12,000 irrigated acres are no longer in agricultural production. Of the remaining 44,700 acres still in production, 42,435 acres or 95 percent have received varying levels of treatment. The annual salt reduction goal of 132,000 tons has been exceeded and currently 134,551 tons are reported as controlled annually. The report indicates that improved irrigation with gated pipe comprises 69 percent of the treatment, concrete ditch comprises 15 percent, and sprinkler, surge, micro-spray and drip irrigation complete the total.

While the Grand Valley project has been very successful in reaching its salt control goal, the wildlife habitat replacement goal remains to be met. Depending on the success of contracting in FY2011, approximately 400 acres of additional wildlife habitat are required to fully replace habitat impacted or lost due to implementation of the salt control measures. NRCS and its partners are actively seeking means to identify and secure these additional acres. NRCS intends to consider its project completed and successful by the end of 2012 even though NRCS will continue to use its authorities and existing programs to provide technical and financial assistance to producers to allow them to meet their natural resource objectives.

Lower Gunnison Basin, Colorado

This project encompasses the irrigated farmland in the Gunnison and Uncompahgre River valleys. With the expansion into the upper headwaters of the Uncompahgre River, implementation is now proceeding in Delta, Montrose, and Ouray Counties. Implementation was initiated in 1988 in this unit. Nearly 58 percent of the salt control goal has been achieved.

The application of salinity reduction and wildlife habitat replacement practices continue to be an integral part of the implementation of Lower Gunnison unit. About 40 new EQIP contracts were developed in FY2011. The major practices are underground pipelines, ditch lining, land leveling, irrigation water control structures, gated pipe, sprinkler, and surge irrigation systems. Even though the lagging national and local economy has slowed the rate of applications somewhat, interest in improving irrigation systems remains high. There is a upward trend in applications for sprinkler systems and NRCS expects this to accelerate if more delivery system infrastructure is improved.

Mancos River, Colorado

This project, near the town of Mancos, Colorado, was initiated and approved for funding and implementation by USDA-NRCS in April 2004. The first EQIP contracts were signed in 2005. Currently, about 50 contracts have been developed with EQIP and Basin States Parallel funds. Five contracts were developed in FY2011. One large wildlife habitat replacement project has been installed. It is anticipated that approximately 5400 acres of improved irrigation systems with salt control benefits will be installed over the project life.

McElmo Creek, Colorado

Implementation was initiated in this unit in 1990. Application of salinity reduction and wildlife habitat replacement practices continue to be implemented in this area with sprinkler systems, underground pipelines, and gated pipe being installed.

Development and use of automatic shutoff valves for sprinkler systems continue to be widely implemented in the project to achieve water management. This project planned to install predominantly sprinkler systems with a small number of improved irrigation systems. The goal for treated acres has been achieved. The salt reduction, however, has reached about 59 percent of the goal. This is likely due to a lower percentage of sprinkler irrigation being installed. This area is also experiencing the conversion of agricultural lands to residential properties. The recent installation of off-farm delivery pipelines by the Montezuma Irrigation Company should enable additional on-farm improvements to occur.

Uinta Basin, Utah

Implementation began in this unit in 1980. Some 80 contracts were developed in 2011. A significant number of systems have reached or are nearing the end of their useful life. While these systems are a lower priority than first-time improvements, NRCS has begun providing incentives for replacement or up-grading. Sprinkler irrigation systems remain, by far, the preferred type of system. Producer participation is exceeding the original projections. Recently awarded off-farm delivery system grants by Reclamation should enable additional on-farm gravity sprinkler systems. While the Uinta Basin Project has exceeded its goals for salt control, significant treatment opportunities exist. About 60 percent of the remaining untreated cropland is controlled or otherwise influenced by the Ute Tribe.

Price-San Rafael, Utah

The Price-San Rafael Project continues to move forward and has reached about 57 percent of its salt control goal. The greatest extent of planning and implementation is occurring in the Huntington-Cleveland portion of the Project. Nearly 60 contracts were developed there in 2011 for $2.5M. All the contracts schedule the installation of high-efficiency sprinkler systems and the on-farm and near-farm pipelines necessary for operation of the systems. The Cottonwood service area is the last untreated phase of the Price-San Rafael Project. As installation of canal replacement is planned for this winter, NRCS anticipates significant EQIP contracting activity there in 2012.

Muddy Creek, Utah

No contracts were developed in the Muddy Creek Project in 2011 but interest remains high. The irrigation district was successful in constructing a large twin-cell water control structure/settling basin and new diversion structure on Muddy Creek. As the district finds the resources to begin replacing the earthen canals, NRCS expects that applications for on-farm improvements will follow.

Green River, Utah

No contracts had been finalized in the project as of August 10. Interest is high but off-farm infrastructure improvements are needed to allow the on-farm systems to operate properly and efficiently. Irrigation is expanding on the plateaus to the east and west of the Green River and above the historic irrigated areas but, as all of the new irrigation systems are high-efficiency sprinklers, NRCS does not anticipate a significant increase in salt loading to the Green River. These expansions are not eligible for the EQIP.

Big Sandy River, Wyoming

Implementation has been underway in this unit since 1988. Approximately 13,500 acres of the planned 15,700 acres have been treated (86 percent) and about 68 percent of the salt control goal has been reached. Producers also report that the water savings from improvements in irrigation systems now allows a full irrigation season of water for the entire irrigation district. In 2011, NRCS developed contracts to provided technical and financial assistance to three producers to up-grade sprinkler nozzle packages. These latest nozzles, along with more intensive soil-moisture monitoring, provide additional irrigation efficiencies and salt savings.

Table 2 – USDA Salinity Control Unit Summary Thru 2010

Unit	[1]Controls (tons)	Potential (tons)	Percent of Goal	Costs	Annualized Costs	Projected total cost	[2]Cost/ton
Mancos River, CO	4,045	11,940	34%	$6,140,175	$509,021	$18,124,522	$126
Muddy Creek, UT	0	11,677	0%	$0	$0	[3]$11,655,523	$75
Manila-Washam, UT	7,087	17,430	41%	6,202,656	$514,200	$15,255,015	$73
Silt, CO	4,038	3,990	101%	$3,489,154	$289,251	$3,447,678	$72
McElmo Creek, CO	25,862	46,000	56%	$18,901,097	$1,566,901	$33,618,841	$61
Uinta Basin, UT	149,030	140,500	106%	$99,575,982	$8,254,849	$93,876,572	$55
L. Gunnison, CO	105,502	186,000	57%	$66,417,187	$5,505,985	$117,093,484	$52
Price/San Rafael, UT	75,507	146,900	51%	$31,174,675	$2,584,381	$60,650,797	$34
Grand Valley, CO*	143,802	132,000	109%	$51,817,220	$4,295,648	$47,564,520	$30
Big Sandy, WY	56,637	83,700	68%	$13,431,318	$1,113,456	$19,849,238	$20
Green River, UT	0	6,540	0	$0	$0	$8,700,000	$0
Totals	571,510	786,677	73%	297,149,464	$24,633,691	$418,180,667	$43

[1]Includes Off-farm funded with EQIP or Basin States Parallel funds

[2]Cost per ton based on amortization over 25 years at 6.625% interest.

[3]Estimate based on project plan.

Grand Valley includes 35,300 tons for on-farm ditches, not part of in-field control.

Concluding Comments

More than three-fourths of the basinwide salt control goal has been obtained. Many of the earliest systems are nearing the end of their planned and useful life. Some systems are beginning to be replaced with new, higher-efficiency systems but the cost per ton may be two or three times the cost per ton of an initial system improvement.

The cost per ton of NRCS-assisted measures has risen from an average of about $50 in 2005 to about $125 per ton in 2011 or an increase of 150 percent.

Urbanization and conversion of agricultural land is significant in some project areas, particularly in Colorado. The nationwide economic recession has created a plateau of costs in most areas but has also made some producers reluctant to sign long-term contracts.

There is a continued need to understand the processes of reducing salt transport from grazing lands and to identify cost-effective salt-control measures.

This page intentionally left blank.

EPA Update
Colorado River Basin Salinity Control Forum
& Advisory Council meetings
August 2011

During Fiscal Year 2011, EPA continued to provide coordination and assistance to the Colorado River Basin Salinity Control Forum and Advisory Council involving salinity control activities: EPA provided several informational updates to the Forum and Advisory Council including updated State and Tribal Water Quality Standards and related program information.

EPA Region 9 has continued the lead role for EPA Regions 6 and 8 for coordination with the Forum and Advisory Council and continues to be available for responding to questions, requests, and other needs. EPA had somewhat reduced participation in Forum meetings during Fiscal Year 2011 due to travel restrictions, retirement and relocation of key staff involved in earlier coordination efforts for the Salinity Control Program. Region 8 will continue in a lead coordination role for salinity control efforts located within Region 8 as will Region 6 within New Mexico.

Colorado Forum representatives as well as Bureau of Reclamation staff have coordinated with EPA Region 8 regarding plans to develop an Environmental Impact Statement for potential changes at the Paradox Valley Salinity Control Unit in Colorado. Plans include a pilot project to evaluate evaporation pond facilities as well as a potential second injection well at the facility to ensure maintenance of the salinity removal capability at Paradox Valley.

The attached table indicates the current status of all the Colorado River Basin States in adoption of the Colorado River Basin Control Forum's salinity standards (Policies and Plan of Implementation). Wyoming did not use the formal Water Quality Standards (WQS) review process, thus EPA approval is not necessary. Colorado reaffirmed its 2005 adoption of the Colorado River Basin Salinity Control Standards without change in December 2008, and stated support of the plan of implementation in the 2008 review prepared by the Forum. Therefore, there were no revisions for EPA to approve.

EPA has approved the applications of five Tribes within the Colorado River basin for "Treatment as States" (TAS) for delegation of the WQS program on their respective tribal lands, specifically;

- The TAS application for the Ute Mountain Ute Tribe was approved by EPA during September 2005. Region 8 is currently reviewing WQS proposed by the Tribe. The Tribe has proposed selenium standards and has several on-going selenium and salinity projects examining potential effects on groundwater, irrigation and endangered species in Tribal and downstream waters.

- The Hualapai Tribe adopted revised WQS in July 2009, including the 2008 Forum Policies and Plan of Implementation. These revised standards were approved by EPA September 25, 2009.

- The TAS application for the Navajo Nation was approved in January 2006, and their WQS were approved during March 2006. The Navajo Nation adopted revised WQS in May 2008 that include the 2005 Forum Policies and Plan of Implementation. Their revised WQS were

approved by EPA in March 2009. They have developed draft WQS which will soon update their current WQS.

•The TAS application for the Hopi Tribe was approved by EPA April 23, 2008. The Tribe's WQS, which they had been most recently adopted in 2000, were approved by EPA July 8, 2008. The Tribe has included the 2005 Forum Policies and Plan of Implementation in WQS revisions which were adopted by the Tribe March 21, 2011, and approved by EPA August 24, 2011.

•The Havasupai Tribe received its TAS approval on April 26, 2011, and we are working with them in completing development of their WQS.

COLORADO RIVER BASIN SALINITY CONTROL STANDARDS UPDATE

Table 3 – Basin States Adoption of Salinity Standards & Plan of Implementation Updates August, 2011

EPA Region – State	2005 Update Adopted* by State	2005 State Adoption Approved* by EPA	2008 Update Adopted* by State	2008 State Adoption Approved* by EPA
R9 – Arizona	Yes -12/02/08	Yes -1/21/09		
R9 – California	Yes – 2/01/06	Yes -- 3/16/06	Yes – 8/04/09	Yes – 3/09/10
R9 – Nevada	Yes – 9/06/06	Yes -4/05/07	Yes - 10/05/10	Yes – 6/15/11
R8 – Colorado	Yes	Yes	Yes- 12/08/08	Not necessary – 2005 adoption reaffirmed.
R8 – Utah	Yes – 2005 & 2008 updates adopted 10/22/08	No	Yes - 10/22/08	Yes – 9/30/09
R8 – Wyoming	Yes – WY Surface Water Trt. Rule	Not necessary – not formally part of WQS	Yes – WY Surface Water Trt. Rule	Not necessary – not formally part of WQS
R6 – N. Mexico	Yes – by reference in WQS	Yes	Earlier version not changed	April 2011

* Adopted/Approved – Some states chose not to adopt Forum Standards during previous review periods because the salinity standards had not changed significantly.

This page intentionally left blank.

Fish and Wildlife Service
Colorado River Basin Salinity Control Program
Fiscal Year 2011

The Fish and Wildlife Service (FWS) Salinity Coordinator has attended all Salinity Work Group and Forum meetings during the past year and has established a good working relationship with the Work Group and Forum members. He is often called upon to address issues related to wildlife values raised by the Forum and Work Group members. He anticipates reviewing the accounting of past wildlife replacement efforts and working on evaluating impacts of future salinity projects to minimize, and replace as necessary, wildlife habitat values foregone.

In 2007, we prepared a report for the Advisory Council entitled *Evaluation and Status of Replacement of Wildlife Habitat Values Foregone*. This report was a culmination of extensive historic data fact finding and field investigations to determine where the Salinity Program stood in relation to replacement of past projects wildlife habitat values foregone. Some comments generated by reviewers suggested that the report was a good factual comprehensive review while others thought the report was a poor representation of the past effort. Determining habitat replacement for salinity projects has been a topic of debate for the Salinity Council, Forum, and Work Group members. Most recently it has been suggested that to bring the Salinity Program into compliance with outstanding debts and to prepare for future wildlife habitat values foregone the Program may need to look into acquiring property that provides the requirements necessary to fulfill the wildlife habitat replacement goals. We see little chance of the Program ever fulfilling the habitat replacement goals as set forth in the Salinity Control Act (Act) without acquiring some key parcels that adjoin existing wildlife management areas or establishing conservation easements in areas that can be managed exclusively for wildlife.

Presently we are reviewing the 2007 report with hopes of updating the acres or habitat values that are currently outstanding for both Reclamation and NRCS salinity projects in Utah, Colorado, Wyoming, and New Mexico. This will give the Council and Forum an opportunity to see where the Salinity Program stands on replacement of habitat values foregone and raise the issue of how can the Federal agencies meet the requirements as set forth in the Act. Our cursory review of three salinity areas in Colorado shows that the Program will need to acquire an additional 400 acres in both the Grand Valley and Lower Gunnison Salinity areas and approximately 150 acres in the McElmo Creek Salinity area. We request that the Council and Forum members review the requirements as set forth in the Act and the role the Service has as oversight for fish and wildlife resources. We recommend the Council and Forum members revisit this report and ask their Bureau and NRCS representatives if they have made progress towards fulfilling their outstanding wildlife habitat replacement goals with properties that fulfill the requirements outlined in the section below entitled *Evaluation and Status of Wildlife Habitat Replacement*.

The following is an excerpt of the 2007 report highlighting the introduction, roles and responsibilities of the Service, and our expectations related to the agencies responsibilities to replace the fish and wildlife values foregone.

Salinity Authorization

The Colorado River Basin Salinity Control Act (43 U.S.C. 1571-1599) authorized the Salinity Control Program and directed the Secretary of Interior to replace incidental fish and wildlife values foregone as a result of implementation of salinity control projects. The Secretary of Agriculture, through the same authorities, as amended and clarified in PL98-569, and through Executive Order 11990, Protection of Wetlands, is also directed to provide for replacement of incidental fish and wildlife values. The Secretary of Agriculture accomplishes replacement of incidental fish and wildlife values foregone by providing incentives and technical assistance for voluntary actions by landowners eligible for Department of Agriculture programs.

Role of the Fish and Wildlife Service in the Salinity Control Program

The Fish and Wildlife Service participates in the Salinity Control Program pursuant to authorities and responsibilities set forth in the Endangered Species Act, Fish and Wildlife Coordination Act, Clean Water Act, National Environmental Policy Act, and the Migratory Bird Treaty Act. The Fish and Wildlife Coordination Act (48 stat. 401, as amended; 16 U.S.C. 661 et seq.), (FWCA) provides that "fish and wildlife conservation shall receive equal consideration and be coordinated with other features of water resources development programs...whenever the waters of any stream or other body of water are proposed or authorized to be impounded, diverted, the channel deepened, or the stream or other body of water otherwise controlled or modified for any purpose whatever, including navigation and drainage". The FWCA applies to activities of greater than 10 acres surface size planned by any department or agency of the United States or by any public or private agency under Federal permit or license. The FWCA further stipulates that such department or agency first shall consult with the FWS and the state wildlife agency with a view to the conservation of wildlife resources by preventing loss or damage to such resources as well as providing for the development and improvement thereof in connection with such water-resource development. The FWS and the state wildlife management agencies are authorized to conduct investigations and prepare a report with recommendations for wildlife conservation and development, lands to be utilized or acquired for such purposes, the results expected, the damage to wildlife attributed to the project and the measures proposed for mitigating or compensating for these damages. The FWS participates in the Salinity Control Program by providing technical assistance on fish and wildlife resource impact assessment, restoration, and management and acting as liaison with and to state wildlife management agencies. The FWS also provides independent review and oversight of program aspects dealing with fish and wildlife resources, including our assessment of the degree to which fish and wildlife have received due consideration in project planning and incidental fish and wildlife values foregone have been replaced.

Evaluation of Wildlife Habitat Values Foregone and Replaced

The FWS evaluates project impacts to fish and wildlife resources according to the following sequence (46 FR 7656, January 23, 1981):

a. Avoidance: We participate with project planners to ensure that all opportunities to avoid impacts are recognized and incorporated into a plan to the extent possible.
b. Minimization: We participate with project planners to ensure that all opportunities to minimize unavoidable impacts are recognized and incorporated into a plan to the extent possible.

c. Compensation: We participate with project planners to evaluate and quantify remaining unavoidable project impacts and identify appropriate measures to compensate for these impacts. Replacement of incidental fish and wildlife values foregone is synonymous with compensation for unavoidable impacts.
Compensation for unavoidable habitat impacts is accomplished through improvement in function and value of other habitats. Therefore, compensation requires a change in some feature such as vegetation, hydrology, or management. Monitoring is not compensation; however monitoring is a necessary tool to determine if habitat improvements have been accomplished such that they are compensating for habitat values foregone. Preservation of existing habitat may be counted toward compensation only under exceptional circumstances when resources are unique, scarce, highly valued, and the threat of the loss of those values is imminent.

The compensatory value of habitat enhancements is determined based on a comparison between the habitat values that existed prior to the enhancement activities (baseline conditions) and the improved habitat values. The difference in habitat values between baseline and improved is counted toward compensation. Compensatory value also takes into consideration whether enhancements improve habitat values similar to those foregone. In general, there is a preference for "in place and in kind" compensation, unless it is determined that other options are ecologically preferable, more sustainable, and more efficient for long term management.

When the Salinity Control Program was first being planned and implemented (1980's), the landscapes involved were principally agricultural. Under those circumstances, in-place and in-kind wildlife habitat replacement was considered appropriate and preferable. However, in recent decades there have been rapid changes in land use in most Salinity Control Program priority areas. Agricultural land has been converted to urban and suburban uses or subdivided into smaller holdings that are not necessarily being managed primarily for agriculture (e.g., ranchettes). These land use changes have rendered in-place and in-kind replacement unfeasible as well as unacceptable from an ecological and managerial perspective. These land use changes have been accompanied by increased public perception of the value and vulnerability of certain habitats, which in turn has fostered the development of both local and large scale natural resources restoration and conservation strategies by planners, conservation groups, and wildlife management agencies.

In recognition of the changes in land use and public priorities for wildlife resources, and in response to concerns raised particularly by NRCS about the difficulties in achieving wildlife habitat replacement in rapidly urbanizing areas, in 2002 the FWS initiated discussions among the wildlife agencies of the various states, Reclamation, and NRCS to develop more-up-to-date and workable criteria for soliciting, evaluating, and selecting wildlife habitat replacement projects. These discussions resulted in development of the following criteria:

1. Restoration/enhancement of riparian and floodplain areas adjacent to perennial streams and naturally occurring wetland complexes is preferred. These habitats are increasingly threatened by land use changes. They provide exceptionally high wildlife habitat value for a wide variety of species. They also protect water quality and provide recreational and visual amenities to communities. If riparian corridor or wetland complex restoration is designed appropriately, most or all of the types of habitats and species affected by both off-farm and on-farm salinity control projects are represented, thereby optimizing the opportunity for "in kind" replacement of all types of habitat values foregone. Restoration and enhancement

measures for such areas include removing or reducing non-native and undesirable invasive plant species, planting native species, restoring or improving hydrology, and managing livestock, recreation, and other human uses in a manner that allows and sustains vegetation communities and wildlife habitat values. These measures are consistent with the expertise, capability, and resources of both the agencies and private landowners.

2. Consistent with and furthers local and area-wide resource management plans and agency and public priorities for species and habitat conservation. This criterion helps assure that habitat replacement proposals are able to garner public support and partnerships to achieve and sustain success.

3. Proximity to a protected area or serves to connect protected areas, such as state and Federal parks, refuges, lands with conservation easements, and other sites managed primarily for wildlife and ecological values.

   Critical size and/or corridor connectivity greatly enhances wildlife habitat value. This criterion recognizes that there is a synergistic effect of protected area size, configuration, and distribution in the landscape, thereby augmenting the gain made by individual restoration and enhancement measures. This criterion also recognizes there are efficiencies of management related to size and configuration. Additionally, larger size or sites that connect to form corridors broaden the opportunity to find willing long term managers.

4. Habitats and measures to be applied will be sustainable with a minimum requirement for long term maintenance and remediation.

   This criterion helps assure that investments in restoration and enhancement will not be compromised over time due to resource constraints nor will management entities incur excessive long term costs.

5. Coordinating the goals, authorities, programs, resources, and expertise of the Salinity Control Program implementing agencies (Reclamation and NRCS).

   This criterion recognizes that the two agencies have different but complementary authorities, resources, and expertise that could improve opportunities, values gained, and success of habitat replacement projects.

   These criteria were developed fairly recently, after many wildlife habitat replacement projects were implemented. The evaluation of wildlife habitat replacement status recognizes and takes into consideration the policies, priorities, and circumstances that pertained when wildlife habitat replacement measures were planned and implemented. In addition, although the criteria above have the support of NRCS, the regulations that guide their programs, particularly EQIP, make achieving consistency with these criteria more difficult, although not impossible.

Evaluation and Status of Wildlife Habitat Replacement

Methods for Evaluation of Wildlife Habitat Replacement Status

Each Salinity Control Program action agency and priority area in the past has used a different approach to assess wildlife habitat replacement needs, solicit, plan, and implement wildlife habitat replacement projects, and monitor status and success. In order to ensure that in the future all habitat replacement is evaluated evenly and consistently between priority areas we suggest the following five criteria be used by the proposing and developing entity of the habitat replacement:

1. Habitat replacement be developed in coordination with the FWS and the state wildlife management agency.

2. Priority be given to development of habitat replacement along important perennial tributaries or known wetland complexes and developed in large enough blocks that facilitate acceptance and oversight by a long term managing entity.

3. Habitat replacement be conducted at sites where the property is protected through ownership or conservation easements dedicated to wildlife management.

4. Habitat improvement activities are applied to sites where water supply, weed management, and planting of native vegetation to promote improved wildlife values is a priority.

5. There be dedicated long term monitoring and management of the area by a qualified entity.

The Service looks forward to continued participation in the Salinity Control Program. We will continue to work with Reclamation and NRCS to determine the amount of habitat needed to see that the salinity projects are current and proportional to acres or habitat that has been lost due to salinity improvements. We are available to provide technical assistance for wildlife habitat replacement planning and implementation and provide assistance to agencies in determining wildlife habitat impacts and replacement accounting methodologies.

This page intentionally left blank.

U.S. Geological Survey
Colorado River Basin Salinity Control Program
Accomplishments for Fiscal Year 2011

The U.S. Geological Survey (USGS) conducts a variety of science activities to aid in the assessment of salinity conditions in the Colorado River, guide program management decisions, and to determine the effect of salinity control efforts. These activities are conducted in cooperation with the Colorado River Basin Salinity Control Forum (CRBSCF) and in support of Federal resource management agencies including BLM, Reclamation, and NRCS. In addition, activities and accomplishments in USGS National programs such as the National Streamflow Information Program (NSIP) and the National Water Quality Assessment Program (NAWQA) provide valuable information to Salinity Control Program (SCP) agencies. These SCP science-support activities and relevant USGS National program activities (described below) range from data collection in a basin-wide monitoring network, to research on the fate and transport of salt at various scales.

Efficient use of USGS resources in coordination with SCP participating agencies has been aided by a science planning process implemented by the SCP Science Team. This science planning process has facilitated the efficient combination of science and data collection activities and study results toward an improved understanding of current and future salinity conditions and remediation opportunities in the Basin.

Twenty-Station Colorado River Basin Monitoring Network and Basic-Data Collection

The USGS monitors 20 key stream sites (stations) in the Colorado River Basin extending from near the headwaters to the Mexican border. Salinity data at the 20 stations are used to assess compliance salinity-level criteria and also track trends in long-term data sets as related to salinity control work. The USGS funds approximately 40 percent of the operation and maintenance of the 20-station monitoring network mainly through the USGS Cooperative Water Program and through NSIP.

Specifically, the program of water-quality monitoring consists of three levels: (1) Monitoring for evaluation of individual salinity control measures, (2) stateline monitoring, and (3) monitoring for determination of annual average flow-weighted concentration in the lower main stem. The Reclamation-developed planning model known as the Colorado River Simulation System or CRSS planning model incorporates data from the monitoring network to simulate both flow and salinity throughout the Colorado River Basin. Each year the USGS computes continuous and monthly total dissolved solids (TDS) concentrations and loads based on data gathered at the 20-station network using the USGS SLOAD model.

In 2010 the USGS evaluated new methods to deliver and model monitoring data from the 20-station network. During mid-term Reclamation studies, water quality results in the CRSS model are substantially impacted by initial model conditions, which include salinity concentrations downstream of major reservoirs such as Lakes Powell and Mead. New modeling methods that provide more timely salinity concentration data would reduce uncertainty in CRSS model predictions. Beginning in 2012 the USGS in cooperation with Reclamation and the CRBSCF will revise the USGS SLOAD model as a means to serving real time salinity estimates on the World Wide Web (specifically, USGS- NWISWeb, http://waterdata.usgs.gov/nwis) and providing more timely incorporation of load

estimates in the CRSS model. Several methods to accomplish this will be considered with final models documented in a USGS series report.

Documenting the Effects of Grazing on Sediment, Water, and Salinity Production from Shale soils – Badger Wash, Colorado

This project is addressing the impacts of grazing on the amount of sediment, salinity, and selenium released from upland soils. Eight paired watersheds were identified within the Badger Wash basin and one watershed of each pair was fenced to prevent access by domestic livestock. This created four watershed pairs. Two of these pairs have an eastern aspect, rolling to steep topography, low levels of channel incision, and have both sandstone and Mancos-derived soils. The other two pairs have a western aspect, steep slopes, highly incised channels, and only Mancos-derived soils.

Activities in 2011 have included measurements of water-borne sediment production, water runoff, wind erosion and the relationship between wind and water erosion in grazed versus ungrazed areas.

Silt Fences: Sediment production from 20 silt fences placed at the base of slopes was monitored at 10 fences in grazed and 10 fences in the ungrazed areas on different soil types. Most silt fences in the grazed areas collected more sediment than fences in ungrazed areas; however this was not true for all the fences and was not statistically distinct given the large degree of variability. As a result, we have identified 10 additional sites where we will install fences in October 2011 to establish whether these differences are due to grazing or a result of the natural variability of the sites. We did find that less sediment was produced by rolling mixed (sand+shale) soils than steep shale slopes, implying that managers should reduce cattle presence on the steep shale slopes.



Runoff collectors: Due to the small storm size, only 3 events reached the installed samplers in Aug-October 2010 and only 2 events in July 2011. All five events reached the samplers in the grazed watershed, but only one event reached the sampler in the ungrazed watershed, indicating that more runoff is occurring in these grazed watersheds. As only one event reached both samplers, salinity contained in the runoff will only be comparable between the watersheds for that one event.

Ponds: During this past year, we have updated and maintained the equipment at the climate stations and at the ponds.

Wind-blown sediment collectors: Data collection continued in 8 dust collectors installed at 15cm, 50cm, and 100cm above the ground, four in a grazed area, and four in the adjacent, ungrazed area. We found no difference in dust collected from grazed versus ungrazed watersheds. As with the silt fences, we collected more wind-blown material from sites on steep shale than on mixed rolling soils. There was also more dust collected on ridgetops compared to lowlands. Again, this would indicate that keeping cattle off of steep shale areas will help reduce soil movement.

Wind and water connection: To better establish whether sediment was moved across soil surfaces into washes, we placed collectors on the ground next to the washes. We have only collected them once; as these samples are still drying, we do not yet have data.

Mancos Shale Landscapes: Science and Management of Black Shale Terranes (a Regional Partnership Project) - Research efforts in the Factory Butte area of central Utah

The Factory Butte area of central Utah is being used as a natural laboratory to study the source and transport of chemical components associated with salinity, selenium, and sediment loading in the Fremont River, a tributary of the upper Colorado River. The current focus of studies is on quantification of erosion processes, soil chemistry, runoff chemistry, and the chemistry of the Fremont River. A principal objective of the study is to establish chemical links between the materials being eroded and those affecting the Fremont River water quality, as well as the quantification of hillslope erosion, which is supplying sediment and solutes to the river.

Monitoring of the Fremont River continued in 2011 at three locations. Temperature and specific conductance are collected in near real-time at the Caineville (http://waterdata.usgs.gov/nwis/uv?09330230) gaging station. Temporary gages have been placed below Caineville (382123110552801) and close to the old Giles (382125110513001) town site and are visited and measured approximately every six weeks. The river reach between the gages above and below Giles is influenced by runoff and possibly groundwater recharge from pre-Cretaceous rocks and agricultural lands. The next downstream reach is affected by runoff from Mancos Shale areas that range from relatively undisturbed to heavily used off-highway vehicle play areas. In addition to data collected at the gages (temperature, specific conductance, and, at the real-time site, discharge), water samples were collected for chemical analyses nine times per year at each of the three sites. Miscellaneous measurements of discharge were done at the same time the water samples were collected.

Peak flow discharge gages have been set up at four drainages to the Freemont in the vicinity of Factory Butte. These gages will be used to determine the peak discharge and, potentially, the volume of runoff from select storm events. The gages were established in the spring of 2011 and will be operated for one year.

In order to sample the solutes moving into the Fremont River during rain events, passive water samplers have been placed on three arroyos draining the North Caineville Mesa area (including the Swing Arm City play area), on Neilson Wash which drains a large area (including a large portion of Factory Butte), and on Sweetwater Gulch which drains a very large undisturbed area south of the Fremont River. Each site has two samplers set at different elevations above the arroyo bed to catch flow at different stages of the storm event.

Hillslope erosion continues to be measured by acquiring repeated high-resolution, ground-based LiDAR, surveys for both disturbed and undisturbed slopes within the three drainages where the soil samples were collected. The digital surveys are used to construct 3-D models of the slopes. Pairs of models developed for different times can then be compared to each other and the quantity of erosion or accumulation of sediment can be determined. Sediment accumulation and erosion on the alluvial plain/pediment surface between North Caineville Mesa and the Fremont River is being evaluated by

making repeated measurements of differences in elevation between fixed points on the surface and fixed points on relatively stable fence posts.
In 2011 USGS conducted several activities to examine impacts of off-road use on sediment movement. Paired silt fences were installed on six slopes in the study area. The lands surface was stressed by driving a motorcycle above one of each pair and measuring sediment moving off the slope. When initially (first storm events after disturbance) disturbed, we saw a large increase in sediment off the disturbed slope; after that, the sediment from each slope was not significantly different. Slopes were re-disturbed in this area this summer, but have yet to have storms sufficiently large enough to measure differences. Dust collectors were installed inside the enclosure at SwingArm and in no-play areas to the west in the study area. Dust production was highest March-July, moderate November to March, and low July to November at all sites. Both wind and ORV activity is highest in the spring. There were very large differences between suspended dust produced at all seasons when the center of the play area (SwingArm) was compared to the no-play area.

To investigate the amount of sediment moving across the soil surface that was capable of being deposited in washes (and then possibly washed out with subsequent high intensity rain events) we installed ground level collectors. Our results show a material moving across the soil surface, when reaching a wash, is deposited in the wash. Preliminary results of data collection show (a) the amount of material reaching the upwind edge of the wash is almost 2-times that on the downwind side of the same wash, (b) ORV activity greatly increases the amount of material moving across the surface and thus the amount likely to enter washes.

Characterization of Hydrology and Salinity in the McElmo Creek Region, Prior to and During Selected Stages of the Construction and Implementation of Irrigation Delivery and Salinity Control Work by the Dolores Project

In the Colorado River basin, the quantification of improvements in water-use efficiency associated with salinity-control projects, the verification of salinity reductions claimed versus actual amounts of salinity reduced, and the determination of natural and human-induced sources of salinity are needed. This information is used for planning of salinity-control projects. It also provides updated calibration and verification data sets for predicting salinity loading in the Colorado River Basin and understanding the effects of land-use change. To develop this information, long-term data sets derived from detailed sampling networks are needed. These data sets exist for the Colorado River Basin, but they often lack the temporal or spatial coverage needed for a detailed analysis. However, for the McElmo Creek region of the Dolores Project, a very comprehensive data set is available. This study will mine the data set for the McElmo Creek region in order to provide information to address critical salinity issues.

The primary objective of the work was to characterize the hydrology and salinity concentrations and loads in the McElmo Creek region. The data set was used to evaluate changes in salinity over time (starting in the early 1970s) using trend analysis techniques. Additional objectives addressed human-induced salinity loading and provide updated calibration data for Reclamation's CRSS model.

The study report is complete and can be accessed at URL: http://pubs.usgs.gov/sir/2010/5218/. Results indicate significant downward trends in salinity load at outflow and inflow sites in the McElmo Creek basin. The total decrease in salinity load at outflow sites was larger than that observed at inflow sites. Data from McElmo Creek at the USGS streamflow gaging station near the

Colorado State Line indicated downward trends on the order of 36,000 tons per year. This decrease exceeds the estimated decreases reported in the Reclamation's 1988 Dolores Project Supplemental Plan Report and NRCS on-farm projections combined.
Additional analysis was done to evaluate agricultural vs. non-agricultural salinity loads. Results indicate approximately 36 percent of the salinity load in McElmo Creek is from non-agricultural sources. Digital data transferred from hardcopy for Reclamation is stored at the following public domain web address: http://rmgsc.cr.usgs.gov/cwqdr/Southwest/ .

Statistical Modeling Applied to Assessing the Distribution of Salinity Load, Load Sources, and the Effects of Land-Use and Water-Use Changes on Loading Rates in Streams of the Colorado River Basin

The USGS has developed a set of models that assess the distribution of salinity loads in surface waters and sources of those loads in the Basin and its sub-regions including ungaged reaches. These models represent the surface-water flow system at a range of scales and are based on conceptual models that relate observed loads in basin streams to up-basin physical characteristics including elevation, precipitation, geology, land cover, and land and water use. Each model has scale-related utility and limitations and together provides a tool set that can be used to improve SCP managers' and planners' understanding of the salinity-load balance in the Basin and to prioritize and optimize SCP resources toward efficient and cost-effective control projects.

Two models have been developed. The models are described below along with ongoing activities to improve these models as program assessment and management tools.

The Upper Colorado River Basin (UCRB) USGS SPARROW model for total dissolved solids (the UCRB SPARROW Model)

Salinity in streams of the UCRB, as measured by TDS concentration and load, is variable. Optimal management and (or) mitigation of salinity requires an improved understanding of the spatial distribution of salinity sources, load accumulation, and transport mechanisms. The USGS SPARROW model relates measured transport at monitoring stations to upland catchment attributes including contributing upstream reaches.

The USGS developed the SPARROW for the UCBR to better understand and estimate the sources, transport, and accumulation of dissolved-solids loads throughout the basin. The project has developed statistically-based estimates of dissolved-solids loading sources and transport for reaches at the subwatershed level throughout the UCRB. The project is based, in part, on a modeling approach for TDS developed by the USGS NAWQA Program for the southwestern United States. The estimates and associated uncertainties obtained from the calibrated dissolved solids SPARROW model for the UCRB provide guidance for future salinity-related data collection and assessment. Up-to-date load statistics for more than 180 monitored locations in the UCRB have been computed.

Predictions of dissolved-solids loads are now available for more than 10,000 stream reaches of the stream network defined in the UCRB. From these estimates, the downstream accumulation of dissolved solids, including natural and agricultural components, were examined in selected rivers. Contributions from each of 11 dissolved-solids sources were also examined at selected locations in the Grand, Green, and San Juan Divisions of the UCRB. At the downstream

boundary of the UCRB, the Colorado River at Lees Ferry monitoring site, the dissolved-solids contributions of irrigated agricultural lands and natural sources were about 45 and 55 percent, respectively.
A USGS Scientific Investigations Report documenting the modeling effort was published in May of 2009. A web-accessible interactive map also was developed and populated with input and output data from the study. The report and the interactive map product are available at http://pubs.usgs.gov/sir/2009/5007/.

The UCRB SPARROW model is being applied by SCP managers to a range of management tasks. The model currently is being used by Reclamation and NRCS to establish estimates of load from agricultural land use outside of designated salinity-control project areas. In many of these areas, data is not available on which to base load estimates and no resources are available to collect data. Model results are also being compared to estimates using other methods including those based on limited (quantity and period of record) data sets to determine whether additional work is needed to improve load estimates.

As this model is receiving heavy use, program managers are interested in enhancing the model and maximizing its utility in program assessment and management. Three principle efforts are underway to improve and update the UCRB SPARROW Model: (1) Developing a new TDS load data set in a subset of active USGS gages in the UCRB, (2) developing a geospatial model describing irrigation status in the UCRB, and (3) assessing the prediction ability of the model over a range of climate conditions. The first task will provide an updated data set that can be used to calibrate an updated and enhance SPARROW model to current precipitation and, land and water use conditions. The second task will provide a spatially consistent and accurate definition of where irrigation is occurring in the basin and the method of irrigation. Irrigation is strongly correlated statistically to the accurate estimation of salinity load in the model. The third task will provide a better understanding of whether the model can be used with confidence to estimate salinity load in the basin under different hydrologic conditions including long-term average precipitation, drought, and wetter than average conditions. These studies are described in more detail later in this section.

A second study, described below, uses similar modeling techniques at a single tributary-basin scale to assess land-use-related sources of salinity and the effects of future changes in land use on loading rates.

USGS LowGunS model – Targeted Water-Quality Modeling in Grand Valley and the Lower Gunnison River Basin Using a Geographic Information Systems

Salinity and selenium water-quality issues in the UCRB of western Colorado have been the focus of remediation efforts for many years. In response to the Salinity Control Act of 1974, Reclamation and the NRCS have focused on salinity control through the CRBSCP and Environmental Quality Incentives Program (EQIP). The primary methods of salinity reduction are lining and piping of irrigation canals and laterals and assisting farmers to establish more efficient irrigation practices on agricultural land. Starting in 1988, the National Irrigation Water Quality Program (NIWQP) began investigations to determine other possible adverse effects of irrigation drainage on water quality in the Western United States. The NIWQP investigations indicated that irrigation drainage contributes a significant part of the selenium load to the UCRB.

These previous investigations determined that a relation exists between subbasin characteristics (Mancos Shale outcrops, agricultural practices, and irrigation water-delivery system design) and salt and selenium loads at the mouths of certain subbasins. In a subsequent investigation, the USGS used this information to develop decision trees and maps to perform a cursory evaluation of the likelihood that an area has (or may have) water-quality problems. The qualitative method developed by the USGS, while effective for large-scale assessments, was less effective at providing specific details essential to the planning and evaluation phases of the remediation process. In FY2004, development began on a water-quality model (also referred to as a regression model) for the Lower Gunnison River Basin using a GIS. Development of this tool, referred to as LowGunS the Upper Colorado Detailed Salinity Model (UCDSM), intended to provide a quantitative method for evaluating the effects of remediation in the Lower Gunnison River Basin and Grand Valley.

Basin characteristics potentially related to the production and mobilization of salinity and selenium were quantified by subbasin boundaries using a GIS. In order to determine the most statistically significant combinations of independent variables, a statistical evaluation of the variables is performed using interactive-stepwise regression. This regression technique uses manual inclusion and exclusion of variables and evaluates the statistical significance of the resulting P-values, R-squared values, residual plots, and F-tests. The result is a multiple-linear regression equation that explains the variations in salinity and/or selenium loading in the study region. A report documenting the model is currently in peer review.

Collection of Water-Quality Data at U.S. Geological Survey Gaging Stations in the UCRB in Support of Dissolved-Solids Modeling and Trend Assessment

A significant obstacle to salinity studies in the Colorado River basin and to the development of regional scale water-quality management tools is the lack of a comprehensive and continuous set of dissolved-solids concentration data. Measurements of specific conductance are relatively inexpensive to acquire and are often used as a surrogate for dissolved-solids concentration values. Adding water-quality field measurements to existing USGS streamgage network in the Upper Colorado would provide a large and valuable set of data that can be used to assess trends and calibrate models of dissolved-solids in the upper Colorado River Basin.

In 2009, the USGS in cooperation with the CRBSCF began a supplemental monitoring program to provide data that can be used to calibrate various models (including the UCRB SPARROW Model) used to predict dissolved-solids loads and transport, and dissolved-solids trends, in the upper Colorado River Basin. The scope of this effort included:

1. Evaluating all existing USGS streamflow gage sites in the UCRB and develop a network of sites for additional water-quality measurements.
2. Measuring specific conductance of streamflow in the defined water-quality streamgage network during each visit to the gaging station (approximately 9-11 visits annually) in the UCRB.
3. In a subset of the new network, collecting 4 water samples each year: one water sample collected within each quartile of the discharge range. All water samples will be analyzed for ROE and one water sample per year will be analyzed for major ions plus ROE.
4. Determining for selected sites whether a significant relation between specific conductance

and dissolved-solids concentration exists; and, if significant, quantify that relation.

This water-quality streamgage network was defined to provide an appropriate distribution of added measurement points in the basin. To best utilize the available funding, water samples have been collected at a subset of sites in the new network. Relations are being defined between specific conductance and dissolved-solids concentration for groups of sites within areas of sub-watersheds with similar and consistent physical characteristics. Thus, these defined relations can be applied to all network gages in a defined area or sub-watershed to estimate annual load.

In 2011, 76 gaging stations in the UCRB were sampled and measured multiple times during water year 2011. Results from the sampling and measurements are stored and available for public retrieval within the USGS NWIS database. The distributed water-quality streamgage network contains 38 in Colorado, 18 in Utah, 12 in Wyoming, 7 in New Mexico, and 1 in Arizona. Three samples per site were collected at each site for ROE analysis and another sample was collected to determine dissolved solids concentration by the Sum of Constituents (SOC) method. Results of the lab analyses and field measurements are stored and made available to the public in the USGS NWIS database. Additionally, we continue to measuring temperature and specific conductance of streamflow in the currently defined water-quality streamgage network during each visit (approximately 9-11 visits annually) in the UCRB.

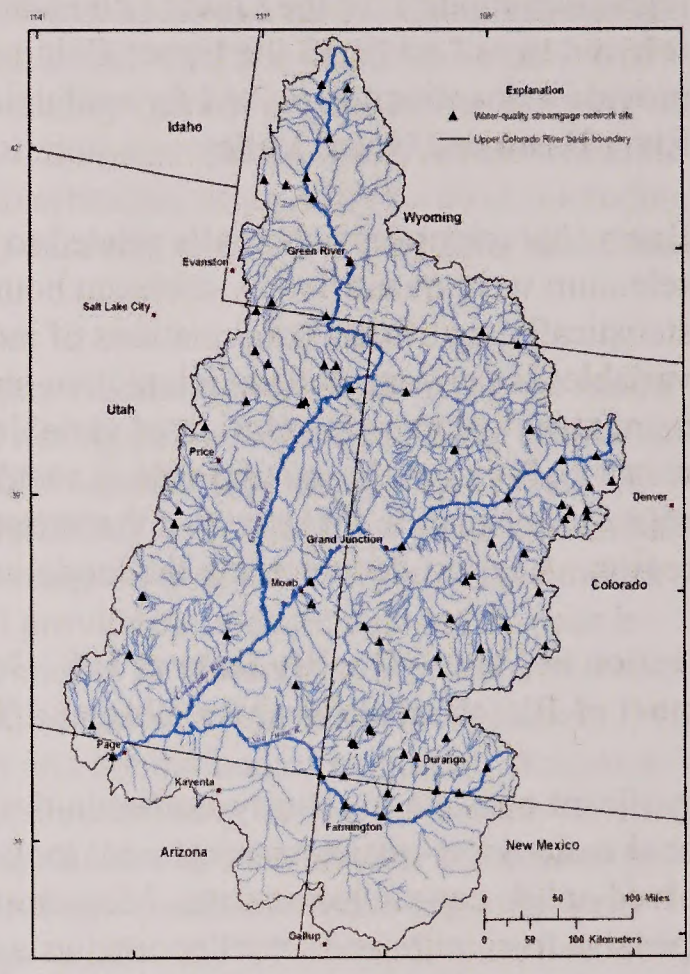


Figure 2 – Map showing distribution of additional water quality monitoring sites in the UCRB

The effort is the third year of a proposed 5-year project.

Mapping irrigated lands and irrigation type in the UCRB

Irrigation in arid environments can alter the natural rate at which salts are dissolved and transported to streams. Flood irrigation generally causes greater dissolved-solids loading to streams when compared with sprinkler irrigation (Kenney and others, 2009). Delineating irrigated agricultural lands in the arid lands of the UCRB and differentiating between flood and sprinkler irrigated land is important to help refine existing dissolved solids loading and transport models. Accurate maps of irrigated agriculture and irrigation practices can also help focus and prioritize salinity control efforts by more precisely identifying areas where water quality may be impacted by irrigation and agricultural practices.

Agricultural lands in the UCRB have been mapped at varying temporal and spatial resolutions by some of the UCRB states (Colorado, Utah, and Wyoming) and by Federal agencies Reclamation and USDA. Most agricultural land maps include field boundaries and crop type information. The

boundaries are mapped at varying spatial resolution and precision using an assortment of techniques and information sources. Colorado and Utah maps include information about irrigation type but are incomplete in some areas and the method used to determine irrigation type varies. In addition, data in these maps are from different time periods. For instance, the Utah agricultural lands map contains field boundaries mapped between 2001 and 2006. Irrigation type is missing in about 50 percent of the Utah map. The Colorado maps represent conditions in both 1993 and 2001. Irrigation type is unknown in 14 percent of the mapped parcels in the 1993 dataset and in 18 percent of the mapped parcels in the 2001 dataset.

A synthesized regional map of irrigated agricultural lands in the UCRB will incorporate information from available state and Federal mapping efforts to create a temporally and regionally consistent dataset of irrigated lands in the UCRB. A refined map of irrigated land that includes irrigation type can be used as a baseline dataset to monitor agricultural landuse and assess irrigation practice change in the future, to improve understanding of dissolved solids loading from irrigated lands, and to improve regional estimates of water use.

The project will be completed in three phases conducted over the course of three years. Phase 1 will be conducted as a proof of concept and methods development phase. GIS, photogrammetric, and remote sensing techniques will be used in conjunction with existing datasets to map and classify agricultural parcels for a single time period in a small study area. Field verification of randomly selected fields will be performed to assess the accuracy of the landuse and irrigation-type classifications. Methods will be tested in multiple areas that have different types of irrigated agriculture and different climates and growing seasons that represent typical climates in agriculture areas in the UCRB.

In phases 2 and 3, agricultural lands will be mapped for the UCRB using techniques developed and refined during phase 1. Phase 2 will focus on mapping the present status of irrigated agriculture. Mapping will be based the best and most recently acquired high resolution imagery available for the UCRB and on 30-meter Landsat satellite data acquired over a similar time period. Phase 3 will focus on mapping irrigation type and location in the mid- to early-1990's. These dates correspond with the calibration of the UCRB SPARROW model (Kenney and others, 2009) and with available mid-1990's high resolution aerial imagery. The completed phase 2 and 3 datasets will be used to analyze agricultural landuse and irrigation practice changes in the UCRB.

The Phase 1 proof of concept was complete in 2011. The results of Phase I were presented to the Salinity Control Program TAG this summer. The TAG approved of continued work on the project in phases 2 and 3.

The results of the mapping effort and analysis of land-use and irrigation-practice change will be documented in a USGS Scientific Investigations Report. Irrigated lands data will be published as a digital GIS dataset on the USGS Water Resources node of the National Spatial Data Infrastructure

Ranking Subbasin Salinity Loads in the Lower Gunnison Basin

In 2008, the USGS began a study to define a ranking of subbasins (by tons of salinity load from a given subbasin) in the Lower Gunnison Basin which will allow for objective, informed targeting of

subbasins for salinity control projects and will provide information to estimate the cost per ton of salinity removed from the system by off-farm salinity-control projects.

The assessment will enhance and then utilize the recently developed LowGunS as a principal assessment tool for the Gunnison Basin.

Work will be conducted in two phases:

Phase I

1. Update and enhance the existing LowGunS model for use as a ranking tool

    - Incorporate improved GIS information for canal and lateral locations (GIS coverages to be updated by Reclamation and not included in the funding request)
    - Incorporate improved irrigation method codes contained in the 2000 irrigated land coverage (irrigation codes to be provided by NRCS and Colorado River Water Conservation District)
    - Review and revise model algorithms to improve utility and accuracy at different scales
    - Update model with results of recent field work and studies

2. Rank subbasins

Phase II - Augment monitoring in high-ranked basins - The results of the ranking exercise will be used to locate high priority areas (cost effective areas for salinity control as determined by Reclamation). This ranking process is especially useful for the data-poor areas that otherwise would have limited justifications for priority salinity control efforts. Water-quality sampling for salinity and streamflow will be done in areas that were data poor and ranked as a high priority for salinity-control projects.

In 2009, a Memorandum of Understanding regarding USGS use of the NRCS/Colorado River Districts Conservation Innovation Grant (CIG) data was successfully drafted allowing work to begin on incorporating information from the CIG into the geospatial information needed to upgrade the irrigated lands/irrigation applied layer for model processing. In 2010, Geospatial information updates were completed as were additional water-quality database reviews. Discussion with Reclamation and other potential model users have explored the incorporation groundwater information into the calibration of the "LowGunS" model. Further discussion of this request is needed prior to revising the original model algorithms as part of Phase I and to finalize the scope of phase II.

Assessing the Effects of Salinity Control Projects in the Lower Gunnison Basin

In 2008, the USGS began a study to quantify the effects of salinity control projects on salinity levels in the Gunnison River at various locations in the Lower Gunnison Basin. Specifically, the study will allow for the estimation of the percent of total observed salinity decrease that is related to on-farm (field irrigation) activities and off-farm (delivery of irrigation water) amounts as well as understanding what portion of the decreasing trend may be from the Upper Gunnison Basin, population growth, and non-agricultural sources.

Study tasks include:

- Assess trends for the Upper Gunnison Basin at the Gunnison River below Gunnison Tunnel streamflow gaging station to determine the portion of the decreasing trend for the Lower Gunnison Basin at the White Water gage that can be attributed to the Upper Gunnison Basin decreases.
- Assess trends in the Lower Gunnison Basin at selected sites to better identify which regions may have the highest rates of decreasing trends and help to bracket agricultural areas and salinity control projects in the Lower Gunnison Basin.
- Use results of trend analysis to identify regions of the Lower Gunnison Basin where the highest rates of decreasing trends in salinity load have occurred.
- Compare trend analysis results to estimates of off-farm and on-farm salinity reduction resulting from salinity control projects in the Lower Gunnison Basin. (More discussion with Reclamation and the NRCS is needed to determine if cumulative estimates for off-farm and on-farm salinity reductions can be obtained for the proposed regions).
- Assess total and annual salinity loading for 1986-2003.

Results of the study are providing the SCP with a better understanding of the portion of the salinity load that has been reduced by factors influencing salinity loads in the Lower Gunnison Basin and provide context for a thorough understanding of the amount and sources of salt that remain to be controlled in the Lower Gunnison Basin.

Preliminary trend analysis results indicate that downward trends in salinity at the Gunnison River near Grand Junction streamflow gage ('Whitewater Gage') result from changes occurring in the Lower Gunnison Basin. These downward trends also appear to occur within areas where the majority of salinity control has been focused in the Lower Gunnison Salinity Control Unit. Some significant upward trends in salinity loads were observed between the 'Whitewater Gage' and the Uncompahgre River at Delta streamflow gage. The cause of these upward trends is not known at this time and further investigation of the trend testing will be done to verify these findings.

In 2010 the analysis was reviewed technically and a method change/clarification was suggested by regional specialists. The changes resulted in little change to the overall trend result; however, more clarification was incorporated into the methods section of the report and a comparison of new and old methods was also incorporated. The final report is in review and scheduled for publication in January of 2011.

Characterization of Salinity and Selenium Loading in the Smith Fork Region of the Lower Gunnison Basin

Reclamation and NRCS are responsible for assessing and implementing measures to reduce salinity loading in the Colorado River Basin. As part of this process, cost-sharing programs are used to involve the agricultural community in the salinity reduction efforts. These cost sharing programs help farmers, ranchers, and canal companies improve the efficiency of irrigation and water delivery systems. These delivery systems have been identified as potential sources of seepage which can cause salinity loading. Reclamation and NRCS wish to prioritize the systems that are the highest seepage sources in order to maximize the effectiveness of the various salinity-control programs. Several salinity-control units (Grand Valley and the Uncompahgre project region of the Lower

Gunnison) have been extensively studied by Reclamation and NRCS; however, some areas of the Lower Gunnison Unit have limited data available with which Reclamation and NRCS can prioritize salinity-control efforts. In order to make reasonable estimates of salinity-load reductions that will result from salinity-control efforts in these data-limited areas, additional information is needed. The study focuses on data collection and analysis for one of the most data-poor regions; the Smith Fork region of the Lower Gunnison Salinity Control Unit.

The Smith Fork region is located near the city of Crawford in western Colorado. The study will assess seven streams in the Smith Fork region including the Smith Fork, Red Canyon Gulch, Alum Gulch, Cottonwood Creek, Bell Creek, Reynolds Creek, and one unnamed stream. These streams receive irrigation water from varying sources including Crawford Reservoir, the North Fork of the Gunnison River, inter-basin diversions, and to a limited extent groundwater.

The specific objectives of the work are to:

- Characterize total annual salinity loads from each stream system.
- Characterize groundwater in natural (unirrigated) and irrigated areas.
- Calculate salinity loading factors for each stream system.
- Characterize natural salinity loads from each stream system.
- Characterize on and off-farm salinity loads in each stream system.
- Calculate salinity/selenium ratios for each stream system.
- Report total annual salinity and selenium loads from the Smith Fork region.

Data collection was completed in 2009 for the study. Surface water salinity loads have been calculated for each sample location. A mass accounting of the surface water salinity load and an estimate of groundwater load is complete. Preliminary loading estimates from this study were delivered to the Reclamation for use in their 2010 Funding Opportunity Announcement (FOA) process. The report documenting the results of the study is complete and in review. The report is scheduled for publication in the spring of 2012.

Lower Gunnison Basin Well Inventory

A recent study conducted by the USGS in the Smith Fork Region of the Lower Gunnison River Basin (LGRB) indicates that groundwater may play a large role in salinity loading to mainstem rivers. Results from the study suggest indirectly that there may be an under accounting of salinity loads in the LGRB because groundwater processes have not been properly characterized. The occurrence of groundwater may also explain discrepancies between loading rates calculated as part of the Smith Fork Region study and salinity models calibrated for the LGRB. Local irrigation entities are requesting that Reclamation further investigate this issue. Typical sampling strategy in the LGRB is to sample surface waters in streams and arroyo's that drain agricultural areas. Little to no groundwater data was historically collected as part of salinity investigations with the exception of the Reclamation well network that was established for the East Uncompahgre Valley 'water and salt budget'. There are also other sources of groundwater information that exist in the LGRB that were not originally associated with salinity investigations. These data can largely be sourced from the USGS, the State of Colorado, and Reclamation.

Available well data/information will be analyzed by a USGS hydrologist who will attempt to establish an understanding of regional groundwater occurrence and volumes as they relate to salinity loading. Areas that appear to have large amounts of groundwater will be compared to areas from the Smith Fork Region study that were thought to have large amounts of groundwater. This comparison will help prove or disprove if there is an under accounting of salinity loading in some subbasins that contribute agricultural return flow to mainstem rivers of the LGRB.

This information will not be published in a USGS SIR, but will be presented to Salinity Control Forum Workgroup and science team members. The presentation will show the methods and results of the well inventory study. Also presented will be recommendations related to how groundwater is thought to be affecting salinity loading in the Smith Fork Region and other areas of the LGRB.

Analysis and Preservation of Historic NRCS Monitoring and Evaluation Work in the Grand Valley and Other Areas of Western Colorado (1985-2002)

The NRCS assessed deep percolation and estimated salt loading derived from irrigated agricultural lands in the Grand Valley in a 1985 to 2002 monitoring and evaluation, hereinafter referred to as "NRCS M&E." That assessment provided a baseline of deep percolation characteristics on agricultural land, and has been used by NRCS to make management decisions related to salinity reduction projects.

The USGS quantified the 2005-2006 deep percolation and irrigation-water application characteristics of residential lots and estates, urban parks, and orchard grass fields in the Grand Valley ("2005-2006 USGS urban irrigation study"), and compared the results to 1985-2002 NRCS M&E results from alfalfa-crop sites.

The NRCS M&E data have never been made public. The data were released internally to the NRCS in a series of annual reports from 1985 to 2003. These data have been subsequently compiled by the NRCS in an Excel spreadsheet. NRCS has asked the USGS to characterize the monitoring and evaluation data set, along with documenting the methods utilized in collecting the data. A regression analysis is desired by the NRCS to examine the M&E data with regards to using site parameters to predict irrigation efficiency and deep percolation of irrigation water. Other correlations of interest will also be discussed in the USGS report. This study begins in October 2011 and is scheduled for completion in December 2012.

Effects of Urbanization on Salinity and Selenium Loading in Montrose Arroyo, Western Colorado

Since 1993, an estimated 75 percent of agricultural land has transitioned to urban land in the lower portion of the Montrose Arroyo subbasin, with most of the transition occurring after 2000. A previous study documented, on a site-specific basis, a decrease in water use and deep percolation associated with the conversion of agricultural lands to urban land use. The project revisits Montrose Arroyo to determine, on a watershed level, the effects of urbanization on salinity loading. The Montrose Arroyo study assesses the integrated effects of multiple types of land use change including the conversion of previously unirrigated land to residential use. The information gained from this study will be used to help understand what the future effects of residential growth will be on salinity levels in the Uncompahgre Valley.

Specific activities include:

- Collect semi-monthly (six samples per year) water-quality data through two irrigation water years (April 2008 through March 2010) at the three sites on Montrose Arroyo sampled by Butler (2001)
- Quantify areas of urban development that have occurred since 2000 using GIS data and data from other sources
- Estimate changes in salinity loading (trends upward or downward) using in-stream data and compare to historical instream data
- If changes are observed, estimate future salinity loads for the east side of the Uncompahgre River Basin
- Provide calibration information for the land-use change algorithm in LowGunS software

Data collection was completed in March 2010. The report documenting the effort is in the final stages of review and will be available in October 2011.

Data presented in the report indicate there was little to no change in salinity levels in Montrose arroyo prior to and after residential development. Substantial conversion from agricultural land to residential land has taken place in Montrose Arroyo (See figures for 1993 and 2008). Previous study found that this land use conversion of this type could potentially reduce salinity levels due to less irrigated area and improved irrigation systems. Additional sampling near an 18-hole golf course may be offsetting any decreases that may have occurred as a result of residential development. Further study near the golf course may be warranted to determine why no reduction in salinity levels was observed.

Figure 3 – 1993 and 2008 Montrose Arroyo Study Area

1993 – Montrose Arroyo Study Area **2008 – Montrose Arroyo Study Area**



Investigation of Transport of Dissolved Solids Discharged from Pah Tempe (La Verkin) Springs, Southern Utah – Phase I, Reconnaissance, Phase II study



Figure 4 – Pah Tempe Spring, Washington County, Utah

Pah Tempe Springs discharge substantial amounts of dissolved solids (salt) to the Virgin River, which are transported downstream and contribute to the salinity of the Colorado River. Consequently, these salts affect the suitability of water in the Lower Colorado River Basin for agricultural, industrial, and domestic uses. Studies conducted in the 1970s and 80s determined that desalinization of the water discharged from Pah Tempe Springs is technically feasible. However, the reduction in dissolved solids that would have been realized in the Colorado River from this type of project was less economical, at the time, than other proposed projects and involved several uncertainties. Consequently, the project was not implemented. During 2007-08 the USGS in collaboration with the SCP conducted an assessment to determine: (1) Whether data collected, or studies completed, in the Virgin River Basin since 1984 conflict with or corroborate the underlying hydrologic and hydrogeologic assumptions and conditions associated with the determination of no action (desalinization) for the La Verkin Springs Unit by Reclamation in 1981 and 1984, and (2) whether hydrologic modifications within the Virgin River Basin since 1984 have affected the transport of dissolved solids from Pah Tempe Springs downstream to below Littlefield, Arizona. The over-arching goal of the SCP is the cost-effective reduction of salinity in the Colorado River. The analysis of retrospective studies and data in a reconnaissance phase of this investigation was conducted during 2008 to provide managers with information needed to determine if they should proceed with a more rigorous and comprehensive assessment of the Pah Tempe Springs salinity load and the development and consideration of possible remediation scenarios.

This first phase of study included a review of existing interpretive studies and management plans and interpretation of more recent data. A conceptual hydro-salinity model for the Virgin River downstream of the USGS gage at Virgin, Utah, was defined, then the hydro-salinity analysis prepared by Reclamation for the La Verkin Springs Unit, its underlying data, assumptions, and conclusions were compared to the updated conceptual hydro-salinity model. A report of study findings in review was completed and delivered to Reclamation in February of 2009. A summary of the results of phase 1 was given to the SCP Work Group and Advisory Council. **Key findings of the reconnaissance phase of the investigation included:**

- Flow and dissolved-solids loads in the Virgin River Basin were substantially different during 1992-2006 than those reported for the period prior to 1971.
- Measurements of Pah Tempe Springs discharge and dissolved solids have varied considerably during the past 20 years.
- Additional flow in the Virgin River from St. George Regional Water-Reclamation Facility outflow and less seepage loss from the river downstream of St. George than was previously reported has affected dissolved-solids transport in the Virgin River.
- Removal of salts discharged from Pah Tempe Springs would result in a larger initial reduction in dissolved-solids loads in the river at Littlefield, Arizona than previously estimated.

Based on the results of the first phase of study, Program managers determined to move forward with a comprehensive investigation. The scope of work for this second phase was defined by recommendations resulting from phase 1 and include

(1) Determine the sources of groundwater discharged from Littlefield Springs and the approximate age of this spring discharge.
(2) Determine the current discharge and dissolved-solids concentration in water from Pah Tempe Springs and identify seasonal variations in these parameters.
(3) Acquire additional data for calibrating Virgin River dissolved-solids load models, particularly in the lower Virgin River Basin (that portion of the basin downstream of the Virgin River Gorge).
(4) Determine if salt reduction in the Virgin River associated with the removal of salts discharged by Pah Tempe Springs will affect the dissolution of salts in soil and rock in downstream agricultural areas or in the aquifer upgradient of Littlefield Springs.
(5) Determine the amount and variation of seepage occurring in the Virgin River reach between Bloomington, Utah, and the USGS streamflow gage above the Narrows in the Virgin River Gorge.



Figure 5 – Virgin River in Timpoweep Canyon immediately downstream of Pah Tempe Springs

A draft document detailing the methods used and results of Phase II is being prepared. Preliminary results from Phase II indicate that recent discharge from Pah Tempe Springs is about 11 cubic feet per second and contributes about 95,000 tons of salt per year to the Virgin River. During 1999-2010, Littlefield Springs discharge averaged about 63 cubic feet per second and contained about 177,000 tons of salt per year. Water emanating from Littlefield Springs is a binary mix of older groundwater moving through the regional carbonate aquifer with more-recent seepage from the Virgin River. While several methods were used to evaluate the relative fractions of the two sources to Littlefield Springs, comparison of CFC-12 and CFC-113 atmospheric mixing ratios provided the most robust estimates, indicating that about 40 percent of Littlefield Springs comes from Virgin River seepage and has an apparent travel time of about 27 ± 3 years. Average seepage from the Virgin River in the Virgin River Gorge during 1992-2010 was about 33 cubic feet per second. Seepage studies found that about 48 percent of the seepage loss occurred in the general vicinity of three faults bisecting the streambed. Geochemical models indicated that removal of Pah Tempe salts from the Virgin River, resulting in the application of more dilute water to agricultural areas near Saint George, could result in more dissolution and salt loading if more efflorescent salts are available, but this increase in dissolution and salt loading should only last one irrigation season. After that time, the quantity of efflorescent salt available for dissolution would decrease because the potential irrigation water will produce a smaller quantity of efflorescent salts. Documentation of results of this study to date has not received

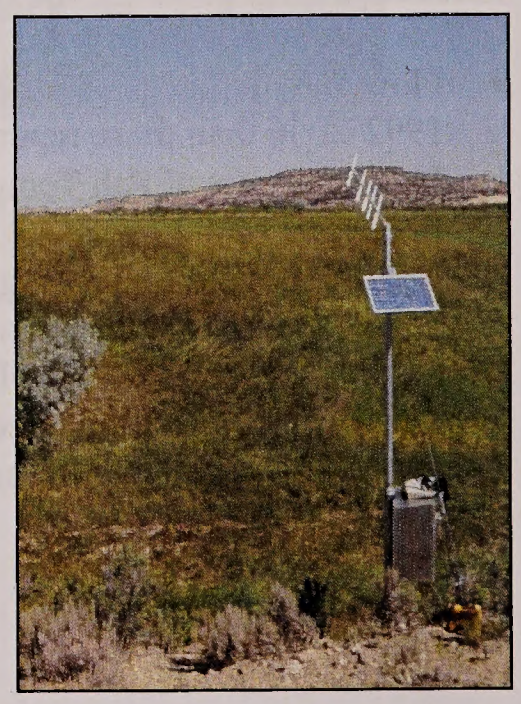


Figure 6 – U.S. Geological Survey water-quality monitoring site in Birch

technical peer review and study results discussed above are subject to change.

Monitoring Salt Loads Discharged from the Manila-Washam Salinity Control Project Area, Utah

During 2004-05, the USGS investigated the occurrence and distribution of dissolved solids in water from the agricultural lands near Manila, Utah, determined the amount of dissolved solids being discharged to Flaming Gorge Reservoir (FGR), and subsequently reported the results in a Scientific Investigations Report (Gerner and others, 2006; available at http://pubs.usgs.gov/sir/2006/5211/PDF/SIR2006_5211.pdf).

The NRCS began implementing a salt-load reduction project in the Manila-Washam area during 2007 that involves converting flood irrigation to gravity-pressure sprinkler irrigation systems. As part of the project implementation, and in support of future projects, the USGS is monitoring the dissolved solids in selected drains and seeps to observe changes that occur during implementation of the Manila-Washam Salinity Control Project (MWSCP).

The largest discharge of dissolved solids from the MWSCP area is from Birch Springs Draw (BSD). Consequently, a streamgage (USGS site 09230300) was installed near the outflow of BSD during May 2007. Discharge, specific conductance, and the water temperature of BSD streamflow have been continuously monitored since the gage was installed and these values are being reported on the web at URL http://waterdata.usgs.gov/ut/nwis/rt. Frequent site visits are being made to this gage to maintain and calibrate the instrumentation. In addition, frequent water-quality samples have been collected from BSD to define the relation between dissolved-solids concentration and specific conductance. Discharge and specific conductance or dissolved-solids concentration have been measured periodically at other major drains and seeps discharging directly to Flaming Gorge Reservoir (FGR) from the MWSCP area. These periodic data and the continuous data collected at site 09230300 are being used to determine the net annual load of dissolved solids discharged from the entire MWSCP area. The project is ongoing.

Preliminary findings of the study from the 2007-08, 2008-09, and 2009-10 reporting periods indicate that during the 2008-10 water years, the estimated net dissolved-solids load discharged into FGR from the Manila-Washam Salinity Control Project area was 21,540; 26,040; and 24,570 tons (provisional), respectively. The dissolved-solids load discharged during this period was much less than the estimated 38,300 tons discharged during 2004–05 into FGR from the Manila-Washam Salinity Control Project area.

Variability of Annual Salt-Load Discharge to Streams in Select Subbasins of the Upper Colorado River Basin

This study uses data sets and modeling tools compiled and developed in previous studies to assess how salinity loads from natural and agriculture-affected areas react to changes in climate (precipitation) and other measurable environmental characteristics. The study will contribute to a conceptual model

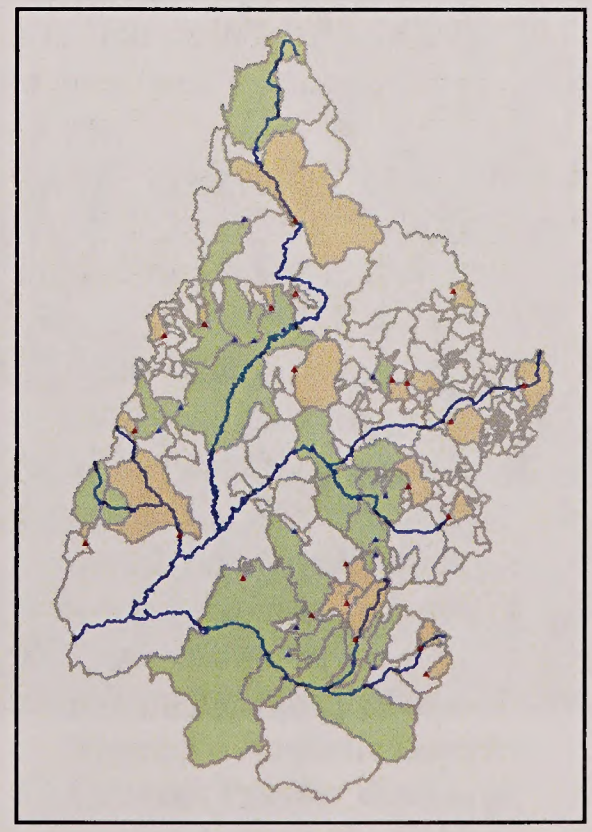


Figure 7 – Upper Colorado River basins initially included in the study (green areas are agricultural basins and brown

that may be used to improve projections of salinity load on the basis of possible future precipitation and water availability conditions.

The Study also aids in enhancing the utility of the USGS SPARROW model for total dissolved solids in the UCRB and the model's continued evolution as a Salinity Control Program management tool. Salinity Control Program managers are interested using the USGS UCRB dissolved-solids SPARROW model (the UCRB SPRARROW model) to assess and estimate salinity loads in selected areas under a range of hydrologic (precipitation) conditions – including average precipitation conditions. This study will test the ability of the UCRB SPARROW model to estimate salinity loads under different climatic conditions that were used during calibration of the model.

The specific objectives and tasks of the study are:

1. Examine natural drainage basins (not affected by agricultural land and water use practices) and define annual and multi-year variations in salinity load. Investigate variations for correlations with changes in precipitation and other environment factors,

2. Examine drainage basins with substantial agricultural influence and define annual and multi-year variations in salinity load. Investigate variations for correlations with changes in precipitation and other environment factors.

3. If relationships between variance in environmental parameters and observed salinity loading can be defined, assess the ability of the USGS UCRB dissolved-solids SPARROW model or a refined version of that model, to examine these variations basin wide including estimations of salinity loads for various time periods and climatic conditions.

Basins (or subbasins) chosen for inclusion in this study are a subset of those sites included in the calibration of the UCRB SPARROW model completed in 2009 by USGS. These basins fit into one of two groups: those in which 10 percent or less of the dissolved-solids discharged from the basin were derived from irrigated land (natural basins), and those in which 70 percent or more of the dissolved-solids discharged from the basin were derived from irrigated land (agricultural basins). The amount (percent) of salt-loading from irrigated lands in each selected basin was determined from the UCRB SPARROW model. Annual dissolved-solids loads associated with selected basins were compared to annual precipitation totals and annual air temperatures for those basins.

A report titled "Analysis of Annual Salt Loading from Selected Natural and Irrigated Catchments in the Upper Colorado River Basin, 1974-2003" documenting the results of tasks one and two above has been written and is currently in review. Key preliminary findings include:

- In general, natural and irrigated catchments vary in similar directions year-to-year but at different magnitudes.
- Measures of variance, or spread, suggest that natural catchments vary between 18 and 35 percent more than irrigated catchments.
- Precipitation and dissolved-solids loads are positively correlated for natural catchments. A weak positive correlation was determined for irrigated catchments. A weak negative correlation between temperature and dissolved-solids load was determined for both natural and irrigated catchments.

- The response to the above average precipitation period of 1982 through 1986 in irrigated catchments generally lagged behind the natural catchments and generally had smaller normalized annual loads. However, on average, irrigated catchments with reservoir storage had the largest normalized maximum annual load in response to the wet period.

The assessment of the performance of the UCRB SPARROW model in predicting annual dissolved solids loads for the years 1974 through 1998 is also complete. SPARROW simulations for each water year were run using annual climate data. To evaluate the how well the model captures the observed annual variability across the basin, differences in predicted annual dissolved-solids loads for each simulated year and 1991 were compared with differences in monitored annual loads for each simulated year and 1991. The temporal trend of the differences between predicted annual loads for the simulated years and the annual load for 1991 generally followed the trend associated with the monitored loads. This suggests that given the representative climatic conditions, the model performs well. Monitored and predicted annual loads over the time period showed to have a strong one-to-one relation. The model appears to under predict the largest annual loads and over predicts some of the smaller annual loads. An under-prediction bias that fell within the approximated model uncertainty was evident in the residuals. A regression analysis on the residuals suggests that some of this under-prediction bias is associated with previously defined downward trends in dissolved-solids concentrations in the basin.
A report documenting this task title "Performance evaluation of a statistical model describing dissolved solids in streams of the Upper Colorado River Basin" has been written and is currently in review.

Dissolved-Solids Loads to the Colorado River in the Reach between the Dewey Bridge and Lake Powell

The Colorado River between the Dewey Bridge and Lake Powell traverses a geographic area where underlying bedrock formations include saline sedimentary formations and evaporite deposits such as the Paradox Formation. Because of a paucity of water-quality data associated with this reach, the dissolved solids contribution to this reach of the Colorado River is poorly understood. The objective of the study is to produce a snapshot of salinity loading to the Colorado River in the study reach through collection of a set of synoptic measurements of streamflow and water chemistry. These results will be used to evaluate the occurrence and possible impacts of natural and anthropomorphic salt loading and provide the Colorado River Basin Salinity Control Program with information needed for evaluating the relation among salt loading to this reach of the Colorado River and Program objectives.

Data were collected in two field events. The second field run was completed in September of this year. Measurements of flow on the Colorado and Green Rivers were made using a boat mounted Acoustic Doppler Current Profiler (ADCP), and integrated water-quality samples were collected by boat from river cross sections using an iso-kinetic sampler. Dissolved-solids loads will be determined from streamflow measurements and dissolved-solids concentration (calculated

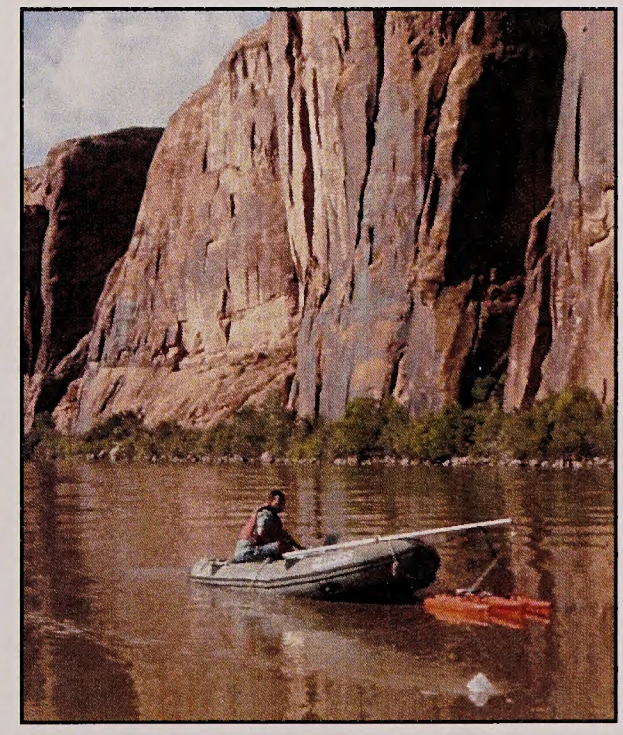


Figure 8 – Acoustic Doppler Current Profiler discharge measurement on the Colorado River above Kane Creek

as sum-of-constituents from major ion analysis). A reconnaissance assessment of chloride/bromide ratios and stable isotopes of oxygen and hydrogen was done prior to data collection to help conceptualize the groundwater/surface-water flow system in this reach of the Colorado River.

Arizona Department of Environmental Quality Cooperative Program

The Arizona Department of Environmental Quality (ADEQ) collects water samples for analysis of major ions, trace elements, and nutrients at the USGS gages located at Lees Ferry and Imperial Dam, both former NASQAN stations. Also, water-quality data are collected on the Colorado River at Parker Dam. Additional samples are collected at the Northerly International Boundary gage, to supplement NASQAN samples. Water at these sites is also analyzed for bacteria.

Report on Sediment Transport in the Bill Williams River during High-Flow Releases from Alamo Dam and Effects on Turbidity and other Water-Quality Indicators in Lake Havasu, 2005-06

In 2005 and 2006, releases from Alamo Dam were increased to approximately 6,000 and 2,000 cubic feet per second, respectively. The releases were used to study the effects of high flows on the river channel, habitat development, and effects on lower Lake Havasu. The USGS collected suspended-sediment data to quantify sediment transport at the mouth of the Bill Williams River and track turbidity and other water-quality parameters in Lake Havasu. A similar release from Alamo Dam was made during the spring of 2005 and the USGS collected sediment data in the Bill Williams River and measured water-quality parameters including turbidity in Lake Havasu during the event. The measurements quantify the delivery of sediment to Lake Havasu and the distribution of turbidity in the lake. The delivery of sediment to and distribution of turbidity in the lake is especially significant because of the proximity of the inlets to the Central Arizona Project. A report (*Sediment Transport in the Bill Williams River and Turbidity in Lake Havasu During and Following Two High Releases from Alamo Dam, Arizona, in 2005 and 2006)* is available online at: http://pubs.usgs.gov/sir/2009/5195/

Report on Sediment Transport in the Bill Williams River during High-Flow Releases from Alamo Dam and Effects on Turbidity and other Water-Quality Indicators in Lake Havasu, 2010

Measurements of discharge and sediment concentration in the Bill Williams River and of turbidity and other water-quality parameters in Lake Havasu similar to those made during 2005 and 2006 were made by the USGS in 2010. An Open File Report (*Discharge and sediment concentration in the Bill Williams River and Turbidity in Lake Havasu During and Following High Releases from Alamo Dam, Arizona in March and April 2010*) that contains the measurements and describes the methods is available online at: http://pubs.usgs.gov/of/2011/1129/

Hydrologic Investigation to Forecast the Future Total Dissolved Solids Concentration of Water Pumped by the Lower Colorado Water Supply Project (LCWSP)

Groundwater pumped by LCWSP wells is delivered to the All-American Canal (AAC) and exchanged, in like amounts, for withdrawals from the Colorado River by water users in California. If the salinity of the groundwater pumped by the LCWSP wells is less than 879 ± 30 milligrams per liter on an average annual flow-weighted basis, it is deemed acceptable for delivery to the AAC.

LCWSP well water may be rejected in whole or in part if the salinity does not meet this criterion. This water quality criterion has been temporarily waived until at least January 1, 2027. The complete, 3-phase, study will investigate the groundwater system near the LCWSP well sites, and will estimate the long-term (tens of years) impact on the salinity of the water pumped by LCWSP wells from all sources. The study will also examine long-term changes in those sources, including the immediate and long-term impacts of the current project to line portions of the AAC, scheduled to be completed by June of 2010. Phase 1 of this study began in 2009 and consists of establishing a monitoring network and completing an initial characterization of the groundwater system. Phase 2 of this study consists of a comprehensive investigation of the groundwater system, including water quality, and its relation to the LCWSP. Phase 3 consists of the development and application of a numerical model of the groundwater system.

Identification and Analysis of Points of Diversion along the Lower Colorado River in Support of Decree Accounting

The U.S. Supreme Court decree, 1964, Arizona v. California, is specific about the responsibility of the Secretary of the Interior to account for consumptive use of water from the mainstream; consumptive use is defined to include "water drawn from the mainstream by underground pumping." Water pumped from wells on the flood plain is presumed to be Colorado River water and the accounting surface can be used to identify wells outside the flood plain in and near the lower Colorado River valley that yield water that will be replaced by water from the river. The objective of this cooperative project between the USGS and Reclamation is to inventory points of diversion including river pumps diverting river water and wells on the lower Colorado River flood plain and adjacent areas in Arizona, California, Nevada, and Utah. Work on the project began in April 1994 to locate sites, provide current information for each well, and provide precise position information in order to apply the accounting-surface method and include the appropriate wells in water accounting along the river. Water levels are required where possible for all wells in areas adjacent to the flood plain. Over 9,054 sites of which 8,701 are wells have been inventoried in the river aquifer along the lower Colorado River. Data on 11,902 wells, 87 springs, and 313 river pumps in Arizona, California, and Nevada have been entered into the USGS Arizona Water Science Center database and sites in California and Nevada are being entered into the California and Nevada Water Science Centers' databases. Site and water-level data are available on the Web within one day of entry to the NWIS at http://waterdata.usgs.gov/nwis and data are uploaded quarterly to an interactive mapping link at http://az.water.usgs.gov/projects/LCRS/.

This page intentionally left blank

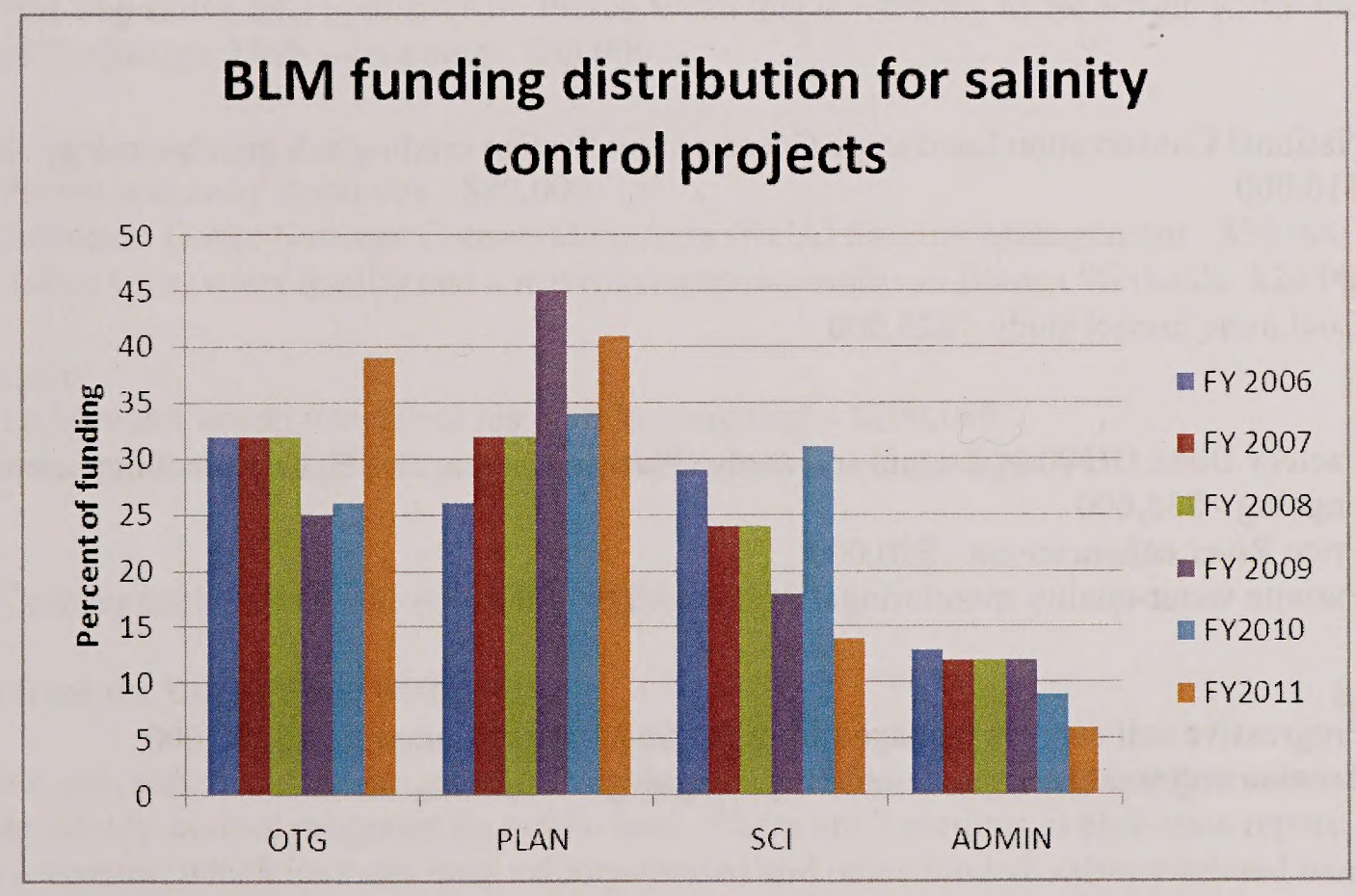
Bureau of Land Management
Colorado River Basin Salinity Control Program
Accomplishments for Fiscal Year 2011

The Bureau of Land Management (BLM) is committed to its role in reducing the mobilization of salt on public lands. The BLM undertakes this responsibility through the multitude of individual management decisions that are made within each BLM jurisdiction. Progress in preventing salt from moving off BLM land is achieved largely through efforts to minimize any soil erosion impacts of grazing, recreation, and energy development, protect riparian areas, reduce off-road vehicle impacts, conduct prescribed burns, and generally manage vegetative cover and reduce erosion. As such, in the past, it has been difficult to single out salinity-control efforts for many of the projects that did have salt savings. In a step to strengthen our reporting effort, a restructuring of the allocation of salinity funding was done and new tracking and accounting systems were put in place in FY 2006. Thus, FY 2011 is the 6th year of reporting under the re-structured system.

General Summary

For FY 2011 $750,000 was allocated for BLM's salinity-control program. Funding goes to 4 major areas: Program administration (ADMIN); Planning (PLAN); Science (SCI); and On-the-ground implementation projects (OTG) (see Figure 9 bar chart below for FY 2006 - 2011).

Figure 9 – BLM Funding distribution for salinity control projects



Tons of salt retained cannot be calculated for program administration, planning, and science projects. However, one of the goals for the re-structured program in FY 2006 was to develop an accounting system to begin calculating more reliable 'tons of salt retained' for on-the-ground implementation projects. At the end of BLM's section there is a spreadsheet entitled: BLM Salinity Program –

FY 2011 Annual Report for Implementation Projects (i.e., on-the-ground tons of salt retained). The information below provides the narrative portion of our annual report.

Program Administration

During FY 2003, BLM created a new full-time, salinity coordinator position. The salinity coordinator began work in FY 2004. FY 2006 was the first full year of the newly re-structured program. The re-structured plan consists of 3 main parts: (1) Allocation of funds to the Upper Basin States (AZ, CO, NM, UT, and WY) based on submittal of project proposals; (2) A tracking system for projects that fit into BLM's Rangeland Improvement Project System (on-the-ground implementation projects); (3) Annual reporting consisting of narratives for on-going and current year, and a worksheet to determine 'tons of salt retained' for on-the-ground implementation projects. The objective for FY 2007 – 2011 program administration was a continuation of the framework put into place during FY 2006; however, there has been an increased emphasis on capturing the amount of salt loading for implementation projects (OTG). Projects that have been science or planning can become implementation projects in future years.

Planning

Planning is an important part of natural resource management. Resource management plans become the 'blueprints' for BLM's near future. As such, this is an opportunity to plan for salinity control, especially for some of our most important activities on public land such as grazing, recreation, and energy development. Planning projects that successfully captured salinity funding for FY 2011 include:

Arizona
- National Conservation Landscape Conservation System eroding salt geochronology - $10,000

Colorado
- Coal mine impact study - $25,000

Utah
- Factory Butte OHV impact and soil study (Planning/Science) – Hybrid planning/science, ongoing - $35,000
- Price River enhancement - $20,000
- Pariette water-quality monitoring - ongoing - $105,000

Wyoming
- Progressive soil surveys managed from the State Office - ongoing - $100,000
- **Erosion sediment transport modeling - ongoing - $30,000**

Science

Salt loading from public lands is often episodic and can be dependent on factors such as: precipitation amount and intensity; topography; content and texture of soils; and the types, amount, and architecture of vegetative ground cover. The transit mode of salt loading can be surface-water runoff, or it can be ground-water recharge to streams and rivers. In a watershed, understanding

which factors are most important and what is the main transit mode of salt loading can necessitate an investigation prior to determining the proper on-the-ground implementation project for good salinity control. The following science projects that investigated salt loading factors were funded during FY 2011:

Colorado

- Vegetation and soil stability project with USGS Biological Resources Discipline (BRD) in Badger Wash (central-western Colorado) to investigate grazing impacts on vegetation and sediments - ongoing - $55,000

Utah

- Salinity control grazing improvement with UDAF - $20,000

On-the-ground Implementation

When mechanisms of how salt loading occurs are understood and once planning is done, on-the-ground implementation projects follow. The success of an on-the-ground project is very much tied to understanding system mechanics and proper planning. The success is also tied to sufficient funding and trained natural resource personnel to go out in the field and construct or carry out the plan.

On-the-ground projects funded by salinity program allocations during FY 2011 include:

Arizona

- Flat Top saline dike system in Ft. Pierce Wash that is tributary to the Virgin River southeast of St. George, Utah – on-going - $40,000

Colorado

- Piceance salinity dynamics - $80,000
- Gunnison Gorge National Conservation Area (NCA) Salinity Management - $35,000
- Saline soils, water quality and a macroinvertebrate study on Blanca Wetlands- $20,000

New Mexico

- La Manga Canyon watershed restoration - ongoing - $100,000
- San Juan River salt/sediment retention structures - ongoing - $30,000

Utah

- Grazing exclosures in the Moab Field Office - $20,000

Reports from the Upper Basin States

BLM state soil, water, and air program leads submitted the following reports that give more detail on their state salinity-control programs on public land. There are 2 sections to each state report: a General summary, which includes both salinity-funded and other-funded, salinity-related work; and, a Specific project summaries section, which is only FY 2011 salinity-funded project descriptions and update reports.

Arizona

General Summary

The Flat Top Dam and dikes system, a major component of the Fort Pierce flood and salinity control system, consists of 1 large dam, and 2 large and 14 small spreader dikes. There are 10 detention dams, 142 dikes, and over 60 check dams in the saline Fort Pierce sub-basin, which is over one million acres, much of which is gypsiferous soils and rock formations. Most of the structures were built in the 1960s, primarily for flood control. The condition of the structures needs to be assessed every few years. Eight of the dikes in the upper Clayhole Valley were assessed in 2011. Ft. Pierce wash is a tributary to the Virgin River which flows into the Colorado River at Lake Mead. Most of the salinity projects are expected to have an effective cumulative life of 10 to 15 years.

Figure 10 – Flat Top #1 overflow pipe exposed before repair



Table 4 – Arizona Strip Accomplishments and Tons of Salt Retained in FY 2010

Specific Project Summaries

Cumulative Accomplishments	Estimated Tons of Salt Retained Yearly
Flat Top #1 Dike – A breach at the dike bleeder (overflow) pipe was repaired in 2011. This dike is sub-lateral to Flat Top dam and it catches overflow from the dam's large bleeder pipe and a small watershed during very high runoff events.	300
A geochronologic study of saline flood plains was conducted on gully erosion ages. Data will be used in conjunction with current and future watershed studies and assessments to determine if there is a total reversal of Holocene sedimentation processes and which soils are threatened and endangered, moving towards extinction.	NA
Rock Crossing #3 Dike – This large dike was repaired in 2010 using a gravel core to prevent piping. Saline sediment and water has started to collect behind the dike. Other Rock Crossing dike repairs on one large and one small breached dike in upper Hurricane Valley were done in the Fall of 2009. Saline sediments and waters are trapped behind the dikes after every storm event.	420
Clayhole Well Dikes – Repairs on 4 dikes were done in the fall of 2008. Saline sediments and waters are still being trapped behind the dikes.	85
Repairs on the Big Warren dikes were done in 2007. They are still successfully trapping saline sediments and detaining salty waters.	310
Flattop Dam – Saline sediments continue to collect behind the repaired (in 2001) dam and upstream on a yearly basis.	1,200
10 dikes in the saline Upper Clayhole Valley were assessed for their condition.	**NA
Over 150 miles of road maintenance were done. This includes requiring the addition of gravel onto the haul roads of uranium mines to prevent dust and erosion.	18
Range Standards and Guides assessment reports were done on 40,000 acres of allotments containing saline soils. AMPs are being revised to address problems on the saline soils.	20
Cattle were temporarily removed from some recently burned allotments.	10
Mitigation of erosion due to uranium mining and exploration is on-going in the development of an EIS which involves about 700,000 acres of which about 150,000 acres are saline soils.	**NA
ESTIMATED TOTAL CUMULATIVE TONS OF SALTS RETAINED IN 2010	**2,363**

****Not all work related to salinity results in direct salt retention. Data and information gathering, and planning, sets the stage for future salt retention projects, and erosion mitigation or prevention.**

Colorado

General summary

The Bureau of Land Management (BLM) in Colorado (CO) is committed to its role in reducing the mobilization of salt on public lands. The BLM maintains and reduces salt delivery to the Colorado River through planning, NEPA analysis, and associated management decisions at four CO Field Offices. It has been determined (in the past) that saline soils predominate in the Uncompahgre, White River, San Juan, and Grand Junction Field Offices. Salinity control projects are funded directly through Washington, DC BLM soil, water, and air program.

Recreation, OHV use, grazing, and energy development activities can increase salt delivery by reducing vegetative cover. Best management practices (BMPs) need to be implemented properly. Planning is the first step in the BMP process. Progress in preventing salt from moving off of BLM land is achieved through efforts to minimize the impacts of grazing, protect and enhance riparian areas, designate OHV corridors, conduct prescribed burns, and basically manage and enhance vegetative cover to reduce erosion.

Specific project summaries

White River Field Office (Meeker, CO):

USGS Monitoring ($40,000): This project allowed the continued support of conductivity meters on two USGS streamflow sites on Piceance Creek which is tributary to the White River and the addition of a conductivity meter on Yellow Creek. These meters provide conductivity values every 15 minutes and are available on USGS's web site (http://waterdata.usgs.gov/nwis). The stations are 09306200 Piceance Creek below Ryan Gulch, Near Rio Blanco, Colorado, 09306222 Piceance Creek at White River, Colorado, and 09306255 Yellow Creek near White River, Colorado. These sites are important to understand potential impacts from oil and gas development in the area and also understanding the salinity loading of Piceance Creek. This project also continues to support three stations on the White River that measure conductivity among other parameters. Of these funds $25,000 went to complete funding on a USGS focused study on Piceance Creek that includes water quality sampling and a tracer study on the reach from Alkali Flats to the confluence with the White River to look at salinity dynamics on Piceance Creek

BLM Monitoring ($40,000): In addition to the support of USGS streamflow measurement and water-quality monitoring, this project allowed for the establishment of a conductivity meter on a streamflow site on Yellow Creek monitored by the BLM. A water-quality study on Yellow Creek was conducted looking at field parameters and flow for water quality and in preparation for a streamflow site on Yellow Creek at the confluence with Barcus Creek and was redone this year. There is a proposal and a National Pollutant Discharge Elimination System (NPDES) permit for surface discharge of treated produced water upstream of salt laden soils in Yellow Creek. An extensive inventory of springs in the Piceance Creek and Yellow Creek watersheds was continued and most of the Piceance Creek basin is now completed. This information is critical to identifying potential impacts from oil and gas development as well as determining what formations are likely contributing salt loading to the Piceance Creek basin which includes Piceance Creek and Yellow Creek.

Figure 11 – 2011 Yellow Creek assessment photo near Stinking Spring (Note salt accumulation on streambanks)



Grand Junction Field Office

Badger Wash: This study is examining whether grazing affects runoff and sediment production in Mancos Shale landscapes, thus potentially increasing salinity inputs to the Colorado River. There were multiple parts to this study. (1) We measured sediment collected by previously-installed silt fences. Although grazed fences in each grazed-ungrazed pair collected more sediment than in the ungrazed areas, these differences were not statistically distinct given the large degree of variability. As a result, we have identified 10 additional sites where we will install fences in October to establish whether these differences are due to grazing or a result of the natural variability of the sites. We did find that less sediment was produced by rolling mixed (sand+shale) soils than steep shale slopes, implying that managers should reduce cattle presence on the steep shale slopes. (2) To examine the amount of soil moved by wind, we measured soil collected in dust traps. We found no difference in dust collected from grazed versus ungrazed watersheds. As with the silt fences, we collected more wind-blown material from sites on steep shale than on mixed rolling soils. There was also more dust collected on ridge tops compared to lowlands. Again, this would indicate that keeping cattle off of steep shale areas will help reduce soil movement. (3) To better establish whether sediment was moved across soil surfaces into washes, we placed collectors on the ground next to the washes. We have only collected them once; as these samples are still drying, we do not yet have data. (4) We have water samplers collecting runoff events. Due to the small storm size, only 3 events reached the samplers in Aug-October 2010, and only 2 events in July 2011. All five events reached the samplers in the grazed watershed, but only one event reached the sampler in the ungrazed watershed, indicating that more runoff is occurring with grazing. As only one event reached both samplers, salinity contained in the runoff will only be comparable between the watersheds for that one event.

These samples have been sent in for analysis. (5) During this past year, we have updated and maintained the equipment at the climate stations and at the ponds.

Figure 12 – Badger Wash water sampler (near man on left side) and flume setup



Red Cliff Coal Mine: Field staff collected data from 3 existing ground-water monitoring wells, collected discharge and water-quality data at 8 established surface-water sites, and performed an assessment of riparian conditions along 6 miles of Big Salt Wash within the 10,000 acre study area. Data are currently being evaluated to better characterize water quality and the interaction between surface- and ground-water resources in the study area which is predominantly situated on highly erodible and saline Mancos Shale soils.

Figure 13 – Well inventory Red Cliff study area



New Mexico

General summary

Road Improvements - Approximately 500 miles of road have been regularly maintained and approximately 12 miles of road were reconstructed to meet road standards. BLM's Civil Engineering technician developed the San Juan Public Roads Committee. This committee includes oil and gas producers, members of the local ranching community, and the Forest Service. The committee has developed road units and has organized and cost shared maintenance activities. This committee has greatly improved the conditions of the local dirt roads and has helped reduced the amount of sediment reaching the river systems from the road network.

Vegetation Treatments - Pinyon-Juniper and sagebrush were selectively thinned by chainsaw to promote the grass production in approximately 50 acres in East Box Canyon and 40 acres in West Box Canyon drainages. These projects help curtail soil erosion and promote improved watershed function. Approximately 150,000 acres of Federal land was inventoried for exotic weed infestation, and about 3,500 acres of land infested with weeds was sprayed to promote native vegetation recovery. Approximately 60,000 of weed treatment areas were monitored to establish the effectiveness of treatment. Farmington applied Tebuthiuron to approximately 20,000 acres of

sagebrush/grassland that had become unhealthy due to excessive densities of sagebrush. Sagebrush in high densities tends to dominate the available soil moisture causing a loss of grass species and an increase in bare ground resulting in increased soil erosion. Tebuthiuron is applied at an appropriate rate to thin the sagebrush but not to eliminate it. Reducing sagebrush densities generally results in increased water availability for grass and forb species which typically increase ground cover and reduce soil erosion.

Silt Traps- Approximately 170 Applications for Permit to Drill (APDs) have been processed this year. Oil and gas operators have been granted an exemption from stormwater runoff by the EPA. A common Best Management Practice (BMP) associated with the building of these well pads is the construction of silt traps to contain sediment runoff associated within the disturbance from the well pad and road construction. Each location generally had a minimum of one silt trap associated with it; in addition, about 125 silt traps were installed in conjunction with road culvert installations. Approximately 300 silt traps were built to help curtail sediment and salt loading and improve water quality in the San Juan Basin.

Riparian – Approximately 500 acres of Largo and Careza Canyon Drainage riparian areas were retreated to kill resprouts of non native Russian olive trees that were initially removed in 2008 and 2009. Approximately 800 acres were initially treated in the Kutz Canyon watershed by removing all Russian olive trees. Crews cut the Russian olive trees with chain saws and the freshly cut stumps were treated with an application of herbicide, and the slash was chipped. Approximately 20 acres of heavily infested Russian olive and saltcedar was removed from two designated river tracts along the San Juan River. After removal of Russian olive and saltcedar, native riparian vegetation is expected to reestablish on these sites

Specific project summaries

All projects are on-the-ground work.

BPS Project 41610 – La Manga Canyon Watershed Restoration - Approximately 100 acres of sage dominated rangeland within the La Manga drainage was mow and drill seeded to establish grass species to reduce erosion during snow melt and storm runoff events. About 100 well pads were inventoried to determine if interim reclamation of well pads resulting in adequate soil stabilization. About 95 well pads were found to have areas on them that did not support sufficient vegetation to stabilize the soil. FFO worked with the oil and gas operators and the 95 well pads were drill seeded to establish new grass. This collaborative effort should result in improved grass densities and reduce the amount of sediment flowing into the La Manga Canyon drainage. Sediment fences were constructed in the active floodplain to stabilize the back of the wash and trap sediment before it reached the San Juan River. Initial mow and seed test plots were monitored, and sediment and pasture fences were maintained.

BPS Project 39324 – San Juan River Retention – Exotic Russian olive trees and saltcedar were removed from the Blanco River Tract. The Blanco tract is located about 12 miles downstream of Navajo Reservoir. Within the Blanco tract, about 10 acres were treated to remove Russian olive and saltcedar. The treatment will result in improved native vegetation stabilizing the banks and improved access for fishing and hunting. Exotic weeds such as Russian knapweed and various thistles were also inventoried and sprayed. Farmington BLM coordinated with the Farmington Public Schools

Youth Conservation Corps (YCC) program to build Sediment fences in an ephemeral wash tributary of the San Juan River. The project consisted of construction of 14 fences along about 3/8 mile of the bank. The fences were designed to stabilize the bank, catch sediment, and promote the establishment of riparian vegetation on the newly deposited sediment. The new sediment fences will reduce the amount of sediment and salts that reaches the San Juan River. The Farmington Public Schools provided 8 workers from the YCC program to help construct the project.

Utah

General summary

In 2011 Utah continued to implement our Healthy Lands and Watershed Restoration program, focused on improving habitat, vegetation, and improving water quality by improving vegetation cover and reducing erosion from BLM lands. These efforts included many watershed improvement projects that will contribute to improved land health and long term reduction of erosion, and sediment, which also benefits the salinity program. Five projects specifically funded by the salinity program were also implemented including wetland restoration and management, wetland research specifically related to selenium (Se) and water quality, research and monitoring on OHV impacts in Mancos Shale terrain, and tamarisk and weed removal to improve riparian areas and protective exclosures for better grazing management near riparian areas.

Funding and project implementation for watershed restoration and salinity reduction has been integrated across several disciplines and programs. The bulk of the restoration work has been conducted utilizing funds provided through the Healthy Lands Initiative, Wildlife, and Riparian Programs. The primary focus of this work is "on-the-ground" restoration work; however, some projects funded directly through the salinity appropriations also included monitoring and research to further guide the design and implementation of salinity reduction efforts in other projects.

The following narrative provides examples of the types of projects that have been implemented that have benefits to the salinity program and are expected to reduce runoff and erosion from BLM lands. Accomplishments are divided into two sections:

I. Statewide activities or programs benefitting the salinity program primarily funded through appropriations outside of the salinity program, including soil, water, air base funding appropriations;

II. Site specific projects funded primarily through salinity funding.

I. Statewide activities or programs benefitting the salinity program:

1. **Utah Watershed Restoration Initiative** - Utah BLM is in its eighth year of cooperative effort in implementing the Utah Watershed Restoration Initiative through its participation in the Utah Partners for Conservation and Development. This is a multi-agency Federal, State, and private partnership treating lands of various ownerships with an emphasis on watershed improvements and long-term habitat restoration. Funds are contributed by partners, including non-governmental organizations and wildlife groups. Projects are submitted and prioritized by regional teams prior to submittal for final approval and funding by the statewide oversight team.

BLM funds primarily come through the Wildlife, Fuels, and Healthy Lands Initiative programs. Although the projects are being conducted statewide, approximately 18 of these were located on BLM lands in the Colorado Plateau Ecoregion and have significant potential long-term benefits; reducing runoff, erosion, sedimentation and salinity to the Colorado River Basin. Over 18,500 acres of BLM lands and 64 miles of stream corridor within the Colorado Plateau were treated in 2011 under this program, although total treatment area including other Federal, State and private lands as part of the cooperative effort is well more than 2 to 3 times that number. Treatments include riparian restoration, tamarisk and Russian olive removal, sagebrush restoration (Dixie-harrow and seeding), removal of juniper through bullhog and hand thinning methods, wildlife and rangeland seeding, cheatgrass treatment and reseeding degraded rangelands, and other similar projects. The Utah Division of Wildlife Resources website has interactive maps and project descriptions: http://wildlife.utah.gov/watersheds/

Here is a partial list of some of the projects in which implementation was or will be completed by September 30, 2011. These are interagency funded projects and funding for most projects is based on the state fiscal year and so most of these were completed earlier this summer and new projects have been initiated after July 1, but will not be reported until next year. More information can be found searching the database utilizing the project number and various report features.

#	Title	
#	Utah Watershed Restoration Initiative Project Name	Acres/miles treated
1718	Bittercreek Riparian Protection	1 mile
1663	Little Hole Cheatgrass Control	182 acres
1671	Deadman Bench Sagebrush Restoration	610 acres
1735	Phase II Green River Habitat Restoration	1645 acres
1653	Big Park Sagebrush Restoration	305 acres
1659	Brush Creek Bench Seeding	407 acres
1658	Archy Bench PJ & Sagebrush Restoration	1,122 acres
1657	Upper Kanab Creek	2,703 acres
1647	Reservation Ridge	83 acres
1662	Indian Springs Fuel Reduction	987 acres + 8.8 miles
1673	BLM Westwater Tamarisk Removal	865 acres +15.5 miles
1730	Black Ridge Fuels Reduction	9034 acres + 38.2 miles
1737	Delores River Invasive Plant Removal and Habitat Restoration	24.5 acres + 1 mile

2. **Climate Monitoring** – Utah has had a long-term climate monitoring program. Data are used in project planning as well as for interpreting results from other monitoring data such as silt fences and sedimentation studies. Soil, Water, Air appropriated funding was used to implement crucial upgrades and maintenance of equipment. These upgrades will continue through 2011. In

addition to updating, standardizing, and automating equipment, partnerships are being developed with local entities, such as the Utah Natural Resources Conservation Service, University of Utah, and the Utah State University (USU) Climate Center to use and manage the data. Legacy data is also being captured and quality assurance being conducted. This data will be merged with other data sets and used in longer-term climate analyses for the Colorado Plateau as well as interpreting ongoing studies related to salinity and erosion within the state. This project has also resulted in hiring students from the University of Utah meteorology program, providing training and land management experience and developing scarce skills for the agency.

3. **Soil Surveys** – Continued soil survey efforts resulted in completion of nearly 175,000 acres primarily in Kane, Piute, and Duchesne Counties. Soil survey inventory can provide better soil salinity and potential erosion information that can be used in project planning and for prioritizing areas for restoration. The Kane County Area Soil Survey field work was completed this year and the maps are expected to be published to the web soil survey in early 2012.

4. **Riparian Restoration** – BLM Utah has been conducting weed treatments, primarily Russian olive and tamarisk removal as well as treatment of noxious weeds such as purple loosestrife, perennial pepperweed, and Russian knapweed in order to improve riparian habitat. Over 585 acres of streamside were treated this year and over 13,000 acres were surveyed for weeds and riparian improvement needs.

Specific Salinity Project Summaries

1. **Pariette Wetlands** is a large artificially-augmented wetland in the northeastern portion of Utah. This has been a long-term, multi-faceted project operating and monitoring the wetland area for wildlife management and salinity/water-quality control. $105,000 in salinity funding this was divided two ways:

   a. A portion was used to match other MLR funds and contribute to labor for a Pariette Wetland Manager. A key purpose of this position is to maintain structures, manage pond water levels and water controls, so that sedimentation/salinity controls operate effectively as designed. Ongoing maintenance includes clean-out and removal of sediment from the water diversion structures, rebuilding dikes and invasive weed control. Labor also included support for water quality sampling as part of our cooperative agreement for water quality monitoring with Utah Division of Water Quality. Data collected included flow (cfs), specific conductance (uS/cm), temperature (deg C), pH, dissolved oxygen (mg/l), and salinity (ppt). Data were collected monthly and sent to the Utah Department of Environmental Quality, Division of Water Quality, who will conduct ion & major constituent analyses, which will be reported in the state water quality database.

   b. Most of the salinity program funding is being used to support a Financial Assistance Agreement with Utah State University Uintah Basin Hydrology Faculty and is supporting a graduate student working on her thesis. The following progress report was submitted by the principal investigator, Paul Grossl, and the student, Coleen Jones:

Pariette Wetlands Salinity/Selenium

Pariette Wetlands is the oasis of the Uinta Basin and was developed in 1972 to improve waterfowl production and provide seasonal habitat for other wildlife species. It encompasses 9,033 acres, 2,529 of which are classified wetlands or riparian and is the largest BLM wetland development in Utah. The wetland contains diverse vegetation and wildlife in an arid climate. Elevated levels of Se have been measured in the wetland and there is concern regarding the impact of Se on wildlife. The goal of this study is to determine the processes responsible for regulating bioavailable Se within the wetland, so as to predict, prevent, and mitigate the potentially toxic build-up of bioavailable Se. We are in the second year of this five-year study. To date our research efforts have involved sample collection and monitoring. This includes measurement of total Se, as well as Se species in wetland soils, sediments, pore waters, and the water column. We are also investigating the role that salinity and organic matter play in Se biogeochemistry.

Multiprobes were installed in 2011 at the wetland inflow and outflow sites. The probes continuously monitor and record pH, dissolved oxygen, turbidity, and salinity. Total water concentrations of Se were less than 20 ppb, and showed temporal and spacial declines. It appears that biogeochemical processes within the wetland, such as Se sorption to wetland sediments and Se volatilization via wetland vegetation, seem to stabilize Se.



The contribution of Se from upland sources such as irrigated agriculture, petroleum exploration and extraction activities, and from inherent natural sources will be determined. Selenium stable isotope ratios are valuable indicators of Se cycling and fractionation in the environment. To determine the contribution of Se from different sources entering the wetland we will evaluate Se stable isotope ratios of drainage waters and associated soils and sediments from sites upland from the wetland. Specifically, we will measure the ratio of $^{80}Se/^{76}Se$ in runoff waters, ground waters, salt deposits, plant tissue, and sequential extracts of soils and sediments, which will allow us to compare and identify Se sources flowing into and through the Pariette wetland.

We will also establish controlled environment greenhouse and laboratory bench scale studies to validate our findings from the field and help us develop strategies to optimally mitigate Se. Ultimately, we will be able to provide recommendations to BLM, water quality and wildlife managers to aid them in the successful and viable management of the Pariette wetland.

c. Additionally a second complimentary study by USGS investigators was initiated to provide additional information about the impact of mineralogy of bedrock and soil on salt storage and the water-rock interaction that controls mobility of salt and high concentrations of Se and Boron.

The primary objective of the study is to collect information that will help land managers determine whether or not the salt and associated contaminants in Pariette Draw can be managed. USGS will collect data to refine knowledge about the role of rock weathering and soil formation in the transport and storage of salt in the watershed and show how salt is cycled under irrigated and natural conditions. Initial funding is being provided through the Colorado River Basin States Salinity Control Program and BLM will provide matching funding in future years.

2. Salinity Reduction/ Grazing Exclosures

The BLM Moab Field Office was granted $20,000 in FY11 to construct 4 grazing exclosures in saline soils. This project was initiated in FY 2010 with 5 exclosures constructed by a local youth corps. This same youth corps built another 4 exclosures this year, and plans to build another 8 exclosures in FY 2012. With these and other existing exclosures, each grazing allotment with more than 10 percent saline soils in the Moab Field Office will have a long term reference site in that allotment.

These exclosures are good reference sites to better understand impacts to moderately saline soils (>8 mmhos/cm) from grazing activity. Most sites are located adjacent to long term range trend study sites. Data from these long term study sites can help direct grazing management actions to ensure good soil conditions. With stable soil conditions, soil erosion and associated salinity loading to the Colorado River Basin is minimized.



Figure 14 – "Monument West KA-6 exclosure, near Thompson Utah"

The Canyon Country Youth Corps (CCYC) provided 8 person crews with 2 crew leaders, and over 2 weeks constructed 4 exclosures 2-3 acres in size. The CCYC are based locally in SE Utah (Monticello), and work with BLM regularly on a variety of projects. They were recognized by the Salt Lake Tribune newspaper with a front page story for their work on this project, and their dedication to hiring youth and training them for careers in land management (see http://www.sltrib.com/sltrib/politics/51636326-90/corps-crew-youth-canyon.html.csp?page=1).

The Moab Field Office has coordinated with Dr. Richard Gill of Brigham Young University on this project. Dr. Gill plans to collect soil and vegetation data within and adjacent to all the new exclosures to document current conditions, and will monitor long term to better understand grazing impacts to moderately saline soils. Monitoring by BLM range and watershed staff will also continue over the long term.

3. **Factory Butte OHV Study -** A long-term study was initiated summer 2007 in the Hanksville area of Central Utah to assess impacts from OHV use on soil and water in Mancos Shale landscapes. A presentation of interim results and findings was given to Field Managers in March 2011. These interim results appear to support decisions made in recent land management planning to redesignate much of the surrounding area from "open" to "travel restricted to existing roads and trails." Although this redesignation was primarily for protection of special status plants, there is a benefit in terms of minimizing impacts from dust and soil erosion. Impacts to water quality are still inconclusive and still in the process of synthesizing data. This is a collaborative project with USGS Biological Resources Division, USGS Geologic Division (USGS-GD), BLM, to assess soil and water quality impacts related to OHV use on Mancos Shale in the Factory Butte area.

Initial work included installation of 6 pairs of silt fences and extensive inventory of soil surface features in disturbed and undisturbed areas. The silt fences are being used in a controlled study comparing OHV disturbed and undisturbed slopes. A fourth season of erosion data was collected this summer from sediment traps/silt fences. Due to additional disturbance activities and concerns for impacts to sensitive plants, funds were also used to obtain sensitive plant clearances and update environmental analyses for this project. In 2009, dust collectors were installed in disturbed and undisturbed areas and in 2010-2011 additional data collection was used to evaluate wind-blown sediments being captured in ephemeral draws during dry periods and flushed into the river systems during storm events.

This project also includes evaluation of relatively new technology in utilizing LIDAR imagery to assess micro changes in surface features and measure erosion rates. An additional set of images were obtained this spring and an assessment of the feasibility of this technology for this type of monitoring and quantitative estimation of soil erosion will be included in the final project report, expected January 2012.

USGS conducted the following monitoring activities during 2011:

a. Upgraded/repaired the paired silt fences. USGS and BLM re-disturbed slopes above the silt fences with a motorcycle this summer, but have yet to have storms sufficiently large enough to measure differences.
b. Completed additional LIDAR imagery and analysis and continued water quality sampling from three gauged sites in the Fremont River and from passive samplers in several selected arroyos for an additional season.
c. Collected additional data from the dust collectors and summarized existing data from previous years. Dust production was highest March-July, moderate November to March, and low July to November at all sites, as would be expected (both wind and ORV activity is highest in the spring). There were very large differences between suspended dust produced at all seasons when the center of the play area (Swing Arm) was compared to the no-play

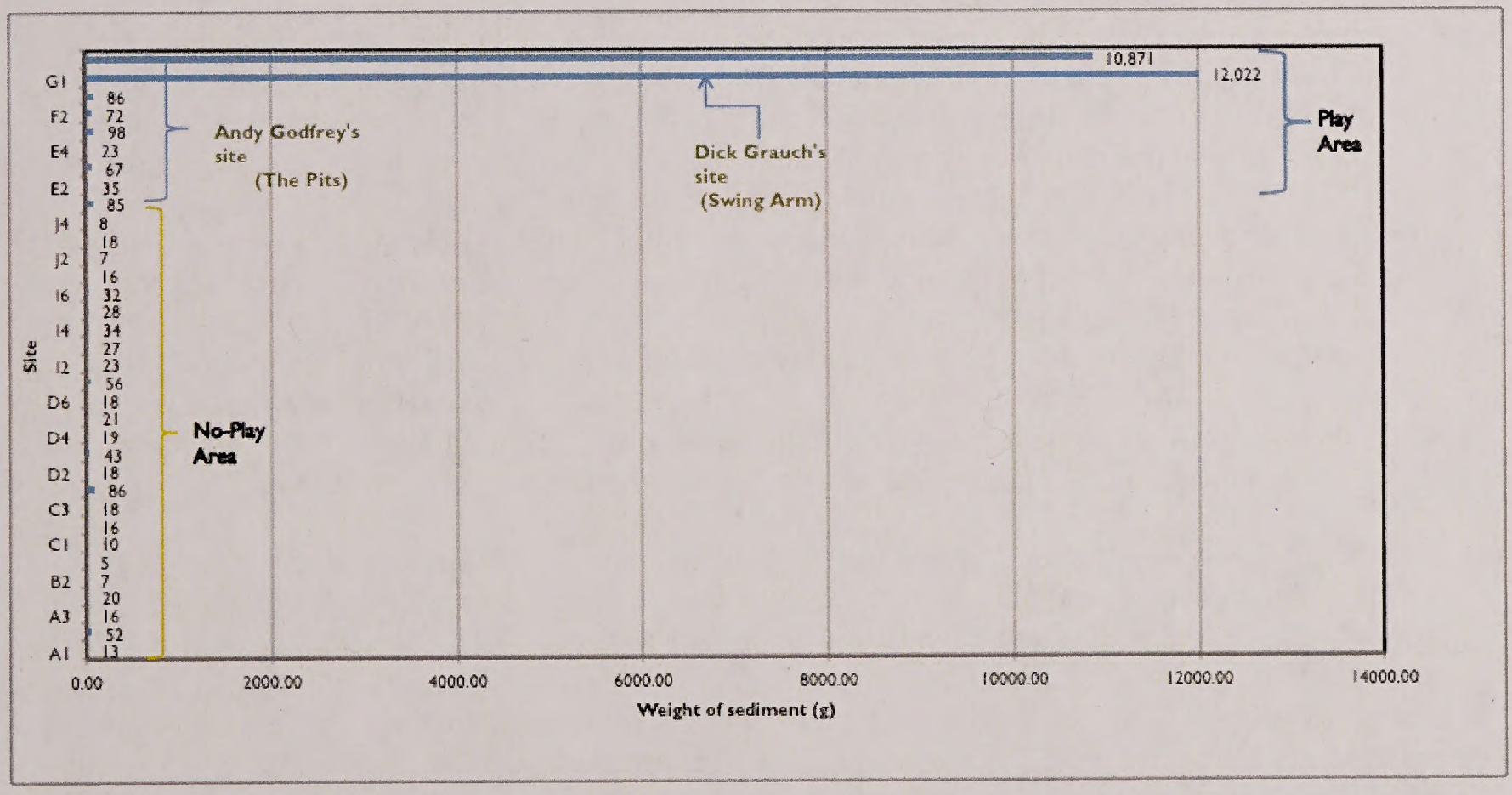
area: For the July-November period, we collected 22 versus 189 g/m^2 collection area/day in the no-play and play areas, respectively. For the November-March period, we collected 8 versus 1182 g/m^2 collection area/day in the no-play and play areas, respectively. For March-July, we collected 16 versus 13,600 g/m^2 collection area/day in the no-play and play areas, respectively.

d. To investigate the amount of sediment moving across the soil surface that was capable of begin deposited in washes (and then washed out with subsequent high intensity rain events) USGS installed ground level collectors. Interim results show:

(1) Material moving across the soil surface, when reaching a wash, is deposited in the wash. Data show the amount of material reaching the upwind edge of the wash is almost 2x that on the downwind side of the same wash (31 g upstream/17 g downstream in Nov-March; 53 g upstream/33 g downstream March-June).

(2) ORV activity greatly increases the amount of material moving across the surface and thus the amount likely to enter washes. November to March, 31g (no-play upstream) and 11,447 g (Swing Arm) was collected; in March-June, this was 53 (no-play upstream) versus 1,312 g (Swing Arm). In October 2011, we will be installing more ground collectors over a larger area to determine the accuracy of these measures.

Figure 15 – Graphical illustration of the amount of sediment moving along the ground surface at Swing Arm (in the middle of the play area), the pits (1.3 miles from Swing Arm), and the no-play area.



In 2011 $55,000 in salinity funds were expended towards this series of related studies in the Factory Butte Area. A portion of that was directed to a new agreement with USGS to expand the study of the link of wind eroded sediments and water quality to other areas in the Colorado Plateau region containing high saline soils. The study focus will be expanded from OHV disturbance near Factory

Butte to include energy development related disturbance and possibly reclamation practices to evaluate potential improvements. Work on the expanded study is commencing this fall and will be part of a graduate student's thesis program.

4. **Nine Mile Canyon Fencing/Range Improvement Project** $10,000 in salinity funds was provided to the Price Field Office to begin implementation of projects identified in the Nine Mile Community Watershed Restoration Planning effort of previous years (partially funded through the salinity program). The first project chosen was a riparian fencing project. Progress to date includes a National Riparian team evaluation, purchase of fencing supplies, purchase of cattle guard, and coordination with the private landowners, NRCS, and the Emery County Road Department. The field work was initiated last fall and initial plans were modified based on input from cooperators. The fence is expected to be completed under contract in late 2011. Evaluation and other restoration techniques will begin once the fencing is in place to protect the riparian corridor. Further background and details were brought forward from the 2010 report and are included below:

Nine Mile Creek is a perennial stream located in north central Carbon County near the border with Duchesne County. It travels approximately 40 miles before flowing into the Green River. Throughout the riparian corridor, riparian habitat loss and stream degradation has occurred due to historic and current grazing use levels, agriculture activities, and run-off from roads. Currently the riparian area at the headwaters is degraded and does not support the desired vegetation and wildlife habitat due to severe soil erosion and head cutting. The headwaters, including the upper three miles of the creek, pass though BLM administered lands.

As part of this salinity project and the continued concern about erosion and water quality, the Price Field Office had the National Riparian Team assist in evaluation of the headwaters and the upper 3 miles of Nine Mile Creek in June of 2010. The riparian area and surrounding uplands contain Cabba family-Guben-Rock outcrop complex and Frandsen-Gullied land complex. During the riparian team evaluation, it was noted that the poor condition of the stream bank vegetation has led to increased erosion and scouring which is exponentially increasing the erosion and sediment transport as the water and sediments travel downstream. The evaluation showed sufficient diversity of species was present for recovery if the grazing pressure was removed. All the shrubs demonstrated arrested architecture and limited reproductive capability, and most of the grasses were grazed beyond acceptable utilization levels. Although this allotment has been closed to livestock grazing since the 1980's, inadequate fencing and the remote location has allowed trespass grazing to occur.

As a result of the evaluation, a fencing plan to exclude livestock was developed and the Price Field Office ordered fencing supplies in 2010. The fence will be constructed during late fall of 2011, with the expectation that if weather and available labor permits that it will be complete as soon as possible. The enclosure would contain approximately 210 acres of riparian habitat on federal, state, and private land within the Nine Mile drainage. This is just the first step in a long process to restore Nine Mile Creek. The project is ongoing and coordination with adjacent landowners, county road department, and the NRCS is continuing.

5. **Price River Enhancement** The BLM Price Field Office was granted $20,000 in FY2011 for the removal of Russian olive and tamarisk from the Price River Watershed. The funding is broken down as follows:

- The Canyon Country Youth Corps received allocated funding for labor to cut Russian olive and tamarisk trees and pile for future burning, apply herbicide to the cut-stumps, to frill-cut single trees and apply herbicide. $14,000 has been allocated, however, work has not commenced.
- Purchase of equipment (hand cans, backpack sprayers) for the Canyon Country Youth Corps to apply herbicide to the cut-stumps and frill-cuts - $830.
- Purchase of herbicide for the Canyon Country Youth Corps to apply to the cut-stumps and frill-cuts and for follow up foliar treatments of regrowth - $5,114.

The project is scheduled for full implementation in the fall of 2011. We are planning to accomplish approximately 350 acres in weed treatment for this project.
We have recently removed Russian olives from the Utah railroad right-of-way as an experiment to see if the use of heavy equipment would be feasible for the project in dense stands. Attached is a photo of the work that was being performed during the early part of the year.

Figure 16 – Heavy equipment removing Russian olives from a Utah railroad right-of-way



Wyoming

General summary

The following narrative provides general estimates of salinity control and/or reduction efforts on Public Lands and a discussion of management actions implemented in Wyoming during FY 2011 to encourage healthy watershed characteristics that may lead to less erosion and salt contributions to the Colorado River. It is recognized that surface disturbance has increased due to BLM approved activities, mostly oil and gas development, and this may reduce the effectiveness of these salinity control projects and related management actions. However, every oil and gas development project includes best management practices to control soil erosion and salt mobilization and reclamation of disturbed areas to promote rapid revegetation and stabilization of site disturbances.

ROCK SPRINGS, KEMMERER, AND PINEDALE FIELD OFFICES

The following information is an estimate of the amount of salt retained on the landscape because of actions taken by the Rock Springs, Kemmerer, and Pinedale Field Offices in FY 2011. This report was written in August 2011, so some projections into the future have been made for the remainder of the year.

Point Sources

No Point sources were addressed in 2011.

Nonpoint Sources

Salt savings from nonpoint sources are estimates only. The BLM is taking steps to make more accurate estimates in the future; however, results are not available at this time.

It is assumed that, through the dissolution of soil salts into surface waters, surface disturbance has a correlation to salt production. Energy development and population increases create a continuing supply of fresh surface disturbance. Improvements in drilling and reclamation techniques have slowed the creation of new disturbance and improved recovery in specific locations, but energy development, recreation impacts and associated disturbances to the soil continue. It is unknown what the final balance is between disturbance and reclamation but State and Federal regulations require erosion control and reclamation efforts on disturbances greater than one acre but given the time required for reclamation to be fully successful, the amount of disturbance continues to increase. Precipitation amounts have been much higher than normal in 2011. This has increased stream flows and improved the potential for vegetative regrowth and watershed stabilization. The relative balance between surface disturbance effects, reclamation benefits, and increased water yield upon salt loading is yet to be determined.

The Wyoming Lands Conservation Initiative (WLCI) http://www.wlci.gov/ and Jonah Interagency Office (JIO) http://www.wy.blm.gov/jio-papo/index.htm provided funding for several projects http://www.wy.blm.gov/jio-papo/whatsgoingon.htm in the area that, while not focused on direct salt reductions, have the potential to reduce salt volumes by improving wildlife habitat and thus focus primarily on vegetation, which also benefits salinity. The volume and cost savings of these projects is unknown.

A variety of activities occurred as part of normal activities in FY 2011 that had the secondary impact of reducing non-point erosion on public lands. Because of the nature of these activities and nature of monitoring, exact volumes of salt saved and the efficiency of each activity are general estimates with a wide range of uncertainty. All the figures below are for the southwestern corner of Wyoming that includes the Rock Springs, Kemmerer, and Pinedale Field Offices. Some of these activities occurred outside the upper Colorado River Basin, but the majority of the activity occurred within the area of interest.

The following assumptions were made for the calculations below:
A work month costs $4,500
Soil averages about 3 percent salt by weight for most soils in the area
The average bulk density of soil is 2.65 g/cc (165.4 lb/cu ft) (4,467 lb/cu yd)

1. **Road Maintenance (Approximately the same as 2006 - 2010)**
   350 miles of road maintained
   Assumptions
   2 cubic yard (cu yd) of soil are retained per mile of road maintained
   About 2 work months = $9,000

   - 350 miles * 2cu yd/mile * 4467 lb/cu yd * 0.03 lb salt/lb soil = 93807 lb salt = 47 tons of salt
   - Cost $9000/47 tons = $192/ton of salt

2. **Structures (Same as 2006 - 2010)** – No new grade-control structures were placed in streams during 2011. However, the structures mentioned in previous reports for this area are still operating and have not required any maintenance expenditures. Given that they are still preventing the upstream advancement of channel drops (headcuts), these structures could be considered to be highly cost efficient in preventing salinity contributions.

3. **Fire Rehabilitation** – Due to late rains and cool temperatures in 2011, only small isolated fires have occurred up to the time of this report. The volume of salt and cost to retain it are unknown at this time.

4. **Grazing Management (Same as 2006 - 2010)**
   28,000 acres of land managed
   Assumptions
   3 cu ft of soil retained for each acre properly managed
   Cost about 20 work months = $90,000 (Additional benefits to public lands also obtained)
   This is a *very rough* estimate actual salt retention can change depending on weather events, soil type, or effectiveness of livestock management on a pasture basis, to name a few of the variables.

   - 28,000 acres evaluated * 3 cu ft soil/ac * 165.4 lb soil/cu ft * 0.03 lb salt/lb soil = 416,808 lb of salt =208 tons of salt
   - Cost $90,000/208 tons of salt = $432/ton of salt

5. **Oil and Gas Activity**
   Much of the oil and gas development activity in the area is taking place in concentrated locations such as the Jonah and Pinedale Anticline Fields but is not exclusive to those areas.

Location in relation to water and land features that would assist salt and sediment transport are highly variable and are addressed by multiple Federal and State regulations. The volume of salt and cost to retain it are unknown at this time.

6. **Plans for future**
   The BLM is promoting the use of the AGWA surface disturbance model, http://www.tucson.ars.ag.gov/agwa/, to analyze surface disturbance within oil and gas field developments in the upper Colorado River Basin. Results from this effort will be used to estimate precipitation runoff and sedimentation from the modeled areas and potential salt mobilization as the result of development. Salt savings and cost per ton retained will then be estimated from reclamation budgets.

RAWLINS FIELD OFFICE

The following is an estimate of the amount of salt retained on the landscape because of actions taken by the Rawlins Field Office in FY 2011.

Point Sources:
No point sources were addressed in FY 2011. The Cherokee Creek Well #1-22 is continuing to discharge groundwater at a variable rate into Cherokee Creek, a perennial tributary to Muddy Creek that ultimately reaches the Little Snake River in Baggs, Wyoming. A flume with stilling well has been installed below the discharging well and water samples, including salinity and turbidity, were taken this field season. Although the BLM has not yet received this information from the University of Wyoming, contributions of salt and sediment to the Colorado River Basin from this discharging well are likely to be minimal due to the location of a large reservoir downstream of the source where sediments and salt are able to settle.

No surface discharge of produced water occurred this fiscal year, although two permits exist for discharge into Muddy Creek, a perennial tributary to the Little Snake River. Monitoring of channel morphology and water quality is ongoing should discharge take place. Although the produced water discharged into Muddy Creek is desalinated and major ionic constituents removed, this clean water may actually attract ions and sediments and increase salinity transport within a system such as Muddy Creek.

A potential new source of sediment and salt was identified this fiscal year. A spring located in T16 R 91 section 3 has begun discharging groundwater at a rate of approximately 10 to 20 gallons per minute. The source of this spring is unknown and until recently was not known to exist. In addition to relatively high TDS at 1140 mg/L and high temperature of 72°F, both water and methane are being released from this spring. Should it continue, the discharge will eventually reach Cow Creek, a tributary to Muddy Creek, and may have impacts on water quality such as increased sediment and salts. Monitoring will continue to take place on this newly identified spring, and should noticeable impacts to Muddy Creek occur steps will be taken to control and/or contain this runoff.

Nonpoint sources:

1. **Vegetation Treatments**
   Approximately 2 miles of stream were planted with willow plugs in order to revegetate disturbed banks. The amount of sediment/salt loading to streams will be reduced once this

vegetation is established. There were no prescribed burns undertaken in the Colorado River Basin portion of the Rawlins Field Office this fiscal year as yet; however there is a planned burn of 400 acres that is anticipated to take place in late September. There was a total of 200 acres of mechanical treatments within the Muddy Creek and Dirtyman Creek watersheds. The acreage of mechanical treatment included removing decadent junipers and dead aspen from the watersheds in order to encourage new vegetative growth and increase vegetative cover, thereby reducing erosion.

2. **Grazing Management:**
This fiscal year, improvements in grazing management on approximately 10,240 acres resulted in the retention of approximately 76 tons of salt (see below):

Assuming that 3 cubic feet of soil is retained for each acre properly managed, that soil average about 3 percent salt by weight in the area, and that the average bulk density of soil is 2.65 g/cc (165.4 lb.cu ft or 4,467 lb/cu yd) then:
10,240 acres * 3 cu ft/acre * 165.4 lb soil/cu ft * 0.03 lb salt/lb soil = 152,432 lb salt = 76 tons of salt.

The improvements included in this year's calculation include the development of 2 impoundments and 2 spring developments that encourage cattle to stay out of riparian areas and concentrate use on upland areas. Streambanks are protected from erosion and riparian vegetation is conserved.

Reservoir Repair:
Seven reservoirs were repaired in FY 2011; no new reservoirs were constructed. Due to the historically high runoff rates from the winter and spring, many reservoirs required repairs. It is difficult to quantify the amount of salts being retained within the reservoirs due to different holding capacities, different soils, and variable precipitation and runoff rate. However, most reservoirs are effective in retaining salt if built and maintained sufficiently.

3. **Roads and Road Maintenance:**
A majority of erosion issues in the Rawlins Field Office originate from road construction and use. Because of the large amount of traffic oil and gas roads carry, in difficult terrain (slopes greater than 10 percent, highly erodible soils, roads that parallel streams/drainages) operators are required to provide the BLM civil engineer and hydrologist with engineered designs. Additionally, hydrologic analyses are required for properly sizing and placing culverts that are needed in larger, more complex ephemeral and perennial systems. It is assumed that smaller quantities of sediments and salts are reaching drainages due to these improvements in design.

Approximately 450 miles of roads were maintained in the Colorado River Basin portion of the Rawlins Field Office in FY 2011. Assuming that 2 cubic yards of soil are retained per mile of road maintained, that soil averages about 3 percent salt by weight in the area, and the average bulk density of soil is 2.65 g/cc (165.4 lb/cu ft or 4,467 lb/cu yd), then
450 miles * 2 cu yd/mile * 4467 lb/cu yd * 0.03 lb salt/lb soil = 120,609 lb salt = 60 tons of salt.

4. **Oil and Gas Activity:**
   The Rawlins Field Office assisted in the plugging and abandoning of 14 wells in FY 2011 within the Colorado River Basin. Wells that have been plugged and abandoned are reclaimed with native vegetation and no longer contribute salt and sediment into the watershed. This includes the wellpads as well as the access roads associated with the wellpads. Actual estimates are difficult to obtain due to the variation in wellpad size and access road length.

SPECIFIC BASIN-WIDE PROJECT SUMMARIES

1. **Progressive soil surveys in 2011** – High resolution soil surveys are continuing on Public Lands in Wyoming's Upper Colorado River Basin with over 190,000 acres of soil survey completed during the summer season and substantially more acres of soil survey are expected before the end of the fall season. The FY 2011 salinity program funding was obligated in cooperative agreements with NRCS in the Lincoln County project and previous years' of funding supported continued soils mapping in Carbon and Sweetwater Counties. These funds support 3rd Order soil survey in the Upper Colorado River Basin. These soil surveys include digitized geospatial and tabular soil data sets with soil interpretations tailored to activities associated with oil and gas (O&G) development and livestock grazing uses. Use of these soil survey products is:

   a. Improving the quality of soil resource impact analysis and mitigation prescription by BLM in the O&G development activities; in addition, are also providing the O&G industry with planning and assessment tools that will allow companies to prepare better operational plans and Storm water Pollution Prevention Plans (a Clean Water Act requirement) in less time and with lower costs;

   b. Providing critical input data for the tailoring of the Automated Geographic Watershed Assessment (AGWA) modeling toolkit for the upper Colorado Basin area (see Item 2). Application of this toolkit allows BLM specialists to identify watersheds most vulnerable to surface disturbing actions and enables users to select the best management options to minimize erosion, runoff, and salt loading to waterways.

This spatial and tabular soils dataset will also be used to identify and protect fragile soil areas (that if disturbed, would impact water quality), aid in control of invasive plant species, select appropriate restoration strategies, and select appropriate management strategies. BLM, State regulatory agencies, O&G companies, and landowners will all benefit from the availability of high quality digital spatial and tabular soils data for their respective needs and applications.

2. **Soil Salinity Study and Automated Geographic Watershed Assessment (AGWA) modeling toolkit -** The BLM is continuing a cooperative project with the University of Wyoming (UW), Wyoming Geographic Information Science Center (WyGISC) and the Department of Renewable Resources to further refine the AGWA modeling toolkit and apply it in environmental impact analysis for oil and gas projects and subsequent project management within the Upper Green (Colorado) River Basin in Wyoming. The objective of this project is to assist in predictive risk modeling of salt mobilization and transport using improved soil salinity mapping and modeling. BLM is working with the University Project Team to perform field research to establish accurate soil salinity and erosion relationships, parameterize existing functional hydrologic models, and develop a mechanistic understanding of salt transport. This team is currently assisting the BLM

in using these tools to prepare analysis models for the LaBarge and NPL oil and gas projects. Additional model preparation and predictive impact analysis is planned for the Moxa oil and gas project. These efforts will provide the quantitative data needed to manage surface disturbing energy development projects in a manner that controls soil erosion and salinity loading.

This page intentionally left blank.

Bureau of Reclamation
Colorado River Basin Salinity Control Program
Accomplishments for Fiscal Year 2011

Salinity Modeling Studies

Colorado River Simulation System (CRSS)

In FY 2011, Reclamation completed modeling studies for the 2011 Triennial Review. Results from two model scenarios were presented to the Salinity Control Forum Workgroup in March 2011. The first scenario included only the present controls in place through 2030, the second scenario included the present controls plus the additional potential controls needed to meet the plan of implementation. Results for the probability of exceedance of the numerical criteria were provided for the 2011 Triennial Review document for each model scenario. Economic damage estimates also were quantified at the three numeric criteria locations in the Lower Colorado River basin based on modeling study results for each scenario.

The salinity removed by water quality improvement projects was updated in November 2010 to account for modifications and extension of salinity control levels provided by Reclamation, NRCS, and BLM as published in the 2010 FAR. Historic salinity control levels are presently available from 1980-2010. The CRSS salinity model and natural salt database was updated to incorporate these data.
Natural flow and salt data were extended through Calendar Year (CY) 2008 in the Upper and Lower Colorado River Basin. The natural flow and salt web page (http://www.usbr.gov/lc/region/g4000/NaturalFlow/index.html) is available through Reclamation's Lower Colorado Region's website. The website provides current and previous version of natural flow and salt data for download and review. Determining natural flow requires consumptive uses and losses (CUL) data which in turn requires county agricultural statistics. County agriculture statistics are typically not available until September of the following year and then an additional 6 months or more are required to determine CUL and then natural flow. The result is a 2-year lag in the results for natural flow. Natural flow results for 2009 were not available in time for the 2011 Triennial Review CRSS modeling scenarios but are expected to be available in the fall of 2011.

Economic Impacts Model

For FY11, Salinity damage model was updated for the Triennial Review. This Model estimates the quantitative damages that are incurred in the metropolitan and agricultural areas in the lower Colorado Basin that receive Colorado River water. The model estimates the impacts from salinity levels greater than 500 TDS on household water using appliances, damages in the commercial sector, industrial sector, water utilities, and agricultural crop revenues. It also estimates the additional costs related to meeting state wide water quality standards for ground water and recycled water use (MWD service area).

For the Triennial Review:

- Household sector 2008 price levels for household appliances
- Agricultural sector, crop prices were updated for Central Arizona area based on the 2007 Census of Agriculture.
- For the Commercial sector, unit costs were indexed to 2008 price levels using the Consumer Price index.
- Producer price index was used to update costs for Water utilities and the Industrial sector.

It was estimated based on the current salinity control program implementation and TDS levels in the year 2030 that damages to the Lower Basin are approximately $520 million annually. If additional projects are implemented in the Salinity Control program, the damages could be reduced by $117 million annually by 2030.

Revision and update of the MWD portion of the Salinity Damage

Meetings with the Metropolitan Water District of Southern California (MWD), Bureau of Reclamation – South Central California Area Office (SCCAO) and the Salinity Coalition have occurred in FY2011. The purpose of the meetings is to scope out the work to be done to update and improve the methodology to estimate salinity damages in the MWD service area. This effort will also try to identify other salinity related damages for this area.

Identification of Unquantified Damages

The Work Group established a subcommittee to work with Reclamation to address unquantified damages. The subcommittee prepared a list of salinity damages that are currently not identified or estimated in the salinity damage model. This list is made up of three categories. These categories are: (1) Reasonable Effort to Quantify; (2) Considerable Effort to Quantify; and (3) Cannot be Quantified but described qualitatively.

Efforts have begun to address some of the issues related to the first category. Specifically, Reclamation contracted for an initial research study on the relationship of salinity to turf at golf courses that use Colorado River water. The FY2012 work on updating the MWD model could also identify some quantifiable damages related to salinity in the Lower Basin.

Science Team

To further improve and expand our knowledge of methods and data used to model salinity within the Colorado River basin, the Salinity Science Team was created. This team incorporates technical experts and coordinators from each Federal agency (Reclamation, USDA, NRCS, BLM, and USGS) that provides salinity data and/or modeling. For more information on the Science Team, please refer to the last section of the USGS Chapter in the 2006 FAR.

The following are some of the topics that were addressed by the Science Team during meetings held in December 2010, March and August 2011:

1. GAO Report on oil shale and water
2. Lower Gunnison and Uinta Basins Planning Studies
3. Modeling relative to climate change

4. Use of SPARROW to determine salt load outside of approved salinity areas
5. Animation of annual salt in the basin using the salinity visualization tool developed by Brigham Young University
6. Desert Lakes Monitoring
7. Study of Pah Tempe (La Verkin Springs) by USGS
8. Paradox Valley Unit – Pilot Evaporation Pond, 2nd well, Alternative Study
9. Rangeland Research Steering Committee
10. Characterization of Hydrology and Salinity in the Dolores Project Area, McElmo Creek
11. Colorado River System Simulation (CRSS) Salinity model
12. Salinity Economic Damages model
13. Updates on Salinity Bible
14. Grand Valley Salinity Control Monitoring Process
15. Reports on awarded Special Projects
16. Review of Research, Studies, and Investigations (RSI) proposals for funding and recommending to the Advisory Council's Technical Advisory Group (TAG) which proposals should receive funding.

Basinwide Salinity Control Program (Basinwide Program)

American Recovery and Reinvestment Act of 2009, P.L. 111-5, February 17, 2009 (ARRA)

The purposes of the ARRA are, among others, to quickly and prudently commence activities that preserve and create jobs promoting economic recovery and to invest in infrastructure providing long-term economic benefits.

Reclamation's Upper Colorado Region solicited applications for reducing salinity contributions to the Colorado River through a Funding Opportunity Announcement (FOA) announced in the spring of 2009. Applications were evaluated and ranked by an Application Review Committee with representatives from the Colorado River Basin States and Reclamation. Reclamation awarded grants in August 2009 totaling more than $11.1 million in ARRA funds and $4.8 million in cost share funds from the Basin Funds to irrigation companies in Colorado, Utah, and Wyoming. These projects will help control nearly 12,000 tons of salt loading.

Table 6 on the following page lists the ARRA projects and their current status. The projects were to be completed by September 30, 2010. Each of the projects had the majority of the construction completed by the time irrigation water was turned on in the spring of 2010 and the remaining construction was completed by September 30, 2010. However, each project requested and was granted additional time to complete habitat replacement measures and other minor tasks. The Red Cap, Farson/Eden, and Lone Pine projects were all completed by March 31, 2011, with the Huntington/Cleveland Project being finished by April 30, 2011. The Peoples Canal project had issues beyond their control in obtaining land for habitat replacement and the project was granted an extension until September 30, 2011. This project is now complete and final wrap up will be done in October 2011.

This page intentionally left blank.

PROJECTS FUNDED BY ARRA	END DATE	Project Summary	Contract Amount	Expended to Date	Balance to Expend	Percent Expended	To Be Completed
Peoples Canal Project	09/30/2011	Construct two settling basins and a screening structure at the canal diversion on the Henry's Fork River. Replace the canal from the settling basin to the last user - 9.1 miles down the existing canal right of way.	$ 7,160,520	$ 7,160,250	$ 0	100%	Habitat Replacement and Mitigation is in the closing stages.
Red Cap Lake Fork Project	3/31/2011	Replace 3.87 miles of the Red Cap Canal and 6.87 miles of laterals with a 10.16 miles pipeline conveyance system.	$ 2,544,257	$ 2,544,257	$ 0	100%	Completed
Huntington Cleveland Project	4/30/2011	Construct 5.1 miles of 30" and 60" pipe, 3 pressure reducing stations, and 2 connections to existing regulating ponds. Abandon 9.1 miles of canal and provide an alternate means to deliver winter livestock water in an additional 20.1 miles of canal.	$ 2,902,538	$ 2,902,538	$ 0	100%	Completed
Farson/Eden Pipeline Pjct	3/31/2011	Replace earth-lined laterals with pipe in a pressurized pipeline network system. Replace approximately 8,324 feet of canal with 8"-18" HDPE DR 32.5 pipe. Convert 2,450 feet of an existing earth-lined lateral to a drainage lateral to drain the system in the fall.	$ 545,120	$ 545,120	$ 0	100%	Completed
Lone Pine Salinity Project	3/31/2011	Pipe approximately 25,512 linear feet of the lower reaches of the Lone Pine Canal with pipe ranging in size from 26" to 36" HDPE pipe. The head pressure developed in this gravity pipe will also be utilized for existing and future on-farm sprinkler improvements.	$ 2,173,268	$ 2,173,268	$ 0	100%	Completed
ADMINISTRATION COSTS			$ 552,869	$ 552,869	$ 0	100%	
		TOTALS	$ 15,878,571	$ 15,878,571	$ 0	100%	

Table 5 – ARRA Funding

This page intentionally left blank.

Price – San Rafael River Basins, Utah

Huntington Cleveland Irrigation Company (HCIC) Project: The Project is located in northern Emery County, in and around the towns of Huntington, Lawrence, Cleveland, and Elmo. The Project was selected in the 2004 Request for Proposals (RFP) and awarded a cooperative agreement in September 2004. A new cooperative agreement was executed in November 2006, and was modified again in September 2009. Approximately 350 miles of open earthen canals and laterals are being replaced with a pressurized pipeline distribution system (Distribution System) to accommodate sprinkler irrigation on about 16,000 acres. Funding for this project is being shared between Reclamation's Basinwide Program, HCIC, NRCS's EQIP, the Parallel Program, and Rocky Mountain Power, formally known as Utah Power and Light. The last of Reclamation's share of $17,116,336 for the Off-farm Distribution System was obligated in 2008. Reclamation can provide up to an additional $6,000,000 in funding equally 50/50 with HCIC funds for completion of the Distribution System. Since 2009, Reclamation has provided over $4,000,000 in additional funding. The Project, scheduled to be completed in 2012, will result in the annual reduction of 59,000 reportable tons of salt in the Colorado River at an anticipated cost of approximately less than $100/ton. Of the 59,000 tons of salt, 13,000 are attributed to the Off-Farm Distribution System and 46,000 tons are attributed to the On-Farm Distribution System and the on-farm salinity control measures (sprinklers).

Cottonwood Creek Irrigation Improvement Project: The $6,509,548 Cottonwood Creek Irrigation Improvement Project is located in Emery County, west of Castledale, Utah. It was selected from the applications received in the 2008 FOA. A Cooperative Agreement was executed in February 2010. Construction began in May 2011, and the project is expected to be operational for the 2013 irrigation season. This project will replace approximately 31 miles of earthen canals and laterals with a pressurized pipeline system resulting in a reduction of 2,094 reportable tons of salt in the Colorado River. It is expected that the pressurized pipeline will induce on-farm improvements resulting in the annual reduction of an additional 9,100 reportable tons of salt. It is anticipated that the project will result in the total annual reduction of 11,194 reportable tons of salt in the Colorado River at an anticipated cost of approximately $59 per ton of salt.

Big Sandy Project, Wyoming

Eden Valley, Farson/Eden Pipeline Project: The Farson/Eden Pipeline Project is located in Sweetwater County, in the vicinity of Farson, Wyoming. It was selected from the applications received in the 2008 FOA. A Cooperative Agreement was executed in February of 2009, for the amount of $6,453,072. This project will replace approximately 24 miles of earthen laterals with irrigation pipe resulting in the annual reduction of 6,594 reportable tons of salt in the Colorado River at an anticipated cost of approximately $52.57 per ton of salt. Laterals E-7, E-8, and E-13 are completed, and work on the West Side Canal is currently being accomplished. The project is scheduled to be completed by 2013.

Gunnison Basin, Colorado

Uncompahgre Valley Water Users Association (UVWUA) Phase 3 Project: In FY 2011, the UVWUA continued construction of Phase 3 of their East Side Laterals (ESL) project which involves the piping of 10.5 miles of laterals under the South and Selig Canal systems and the reduction of about 2,300 tons of salt loading annually. This phase is utilizing $1.3 million of salinity-control

funding as well as funding from the Reclamation's Departmental Irrigation Drainage (selenium) Program. Construction of Phase 3 was substantially complete in the summer of 2011.

UVWUA Phase 4 Project: As a result of the 2008 FOA, the UVWUA was awarded a cooperative agreement for Phase 4 of the ESL in December 2008. This phase involves an additional 11 miles of laterals under the Selig and East Canal systems and the reduction of about 3,700 tons of salt loading annually. Approximately $2 million of salinity-control funding will be supplemented with approximately $800,000 from a Section 319 grant obtained through the Colorado Division of Public Health and Environment. Construction of one short lateral was completed in FY 2009. Additional laterals were completed in FY2010-11 and the remaining portions of Phase 4 will be completed in 2012.

UVWUA Phase 5 Project: As a result of the 2010 FOA, the UVWUA was awarded a $4.3 million cooperative agreement for Phase 5 of the ESL. This phase involves an additional 19 miles of laterals under the Selig and East Canal systems and the reduction of about 5,034 tons of salt loading annually. Construction will begin in November 2011.

UVWUA Phase 7 Project: As a result of the 2010 FOA, the UVWUA was awarded a $3.2 million cooperative agreement for Phase 7 of the ESL. This phase involves an additional 12.7 miles of laterals under the Selig and East Canal systems and the reduction of about 3,029 tons of salt loading annually. Construction is anticipated to begin in the fall of 2012.

Grandview Canal and Irrigation Company Project: Awarded from the 2008 FOA, this project involves piping a portion of the Grandview Canal and several laterals in an area tributary to the North Fork of the Gunnison River near Crawford in Delta County. In July 2009, Reclamation entered into an agreement to provide $5.3 million to pipe 4.8 miles of main canal and 5 miles of laterals and convert about 900 acres of currently flood-irrigated farmland to sprinkler irrigation. Construction began in September 2010 with completion expected by late 2011. The remaining work includes habitat mitigation and filling in the old canal prisms. The project is expected to reduce salt loading by 6,400 tons/year.

Reclamation entered into a cooperative agreement with the Delta Conservation District to map and collect information on water diversion, canals and laterals, and irrigation practices in the Lower Gunnison Basin. This information has been needed for participation in the FOA process. 2011 mapping focused on the North Fork and Delta areas. Additional data collection is needed in other areas i.e. Colona, Bostwick Park.

Grand Valley, Colorado

Grand Valley Irrigation Company (GVIC) Project: As a result of selection under the 2008 FOA, the GVIC was awarded a $3 million cooperative agreement to line about 2.9 miles of their main canal within the city of Grand Junction. A salt loading reduction of approximately 4,500 tons annually is expected. The canal lining will consist of a PVC membrane with a shotcrete cover. Construction began in November 2008 and approximately 2.9 miles of canal lining have been completed. The project was completed under budget and the remaining funds will be utilized to line approximately 1000 ft of additional canal in the fall of 2011 controlling about another 290 tons of salt. The habitat replacement work was completed in the summer of 2010.

As a result of selection under the 2010 FOA, the GVIC was awarded a $2.8 million cooperative agreement to line about 1.9 miles of their main canal and pipe about 4,100 ft of ditch within the Grand Valley. A salt loading reduction of approximately 1,749 tons annually is expected. The canal lining will consist of a PVC membrane with a shotcrete cover and the pipe will be concrete. Construction will begin in December 2011.

San Juan River Basin, New Mexico

San Juan River Demonstration Project: The San Juan River Dineh Water Users, Inc. operates the Hogback and Fruitland irrigation projects located on both sides of the San Juan River near Shiprock, NM. The projects consist of about 50 miles of lined main canals and over 250 miles of unlined laterals that provide water to about 13,000 acres of irrigated land. The average irrigated parcel size is about 13 acres. This $194,000 demonstration project would replace an open lateral approximately 7,900 feet long with about 5,000 feet of PVC pipe. The estimated salt savings for this activity is about 199 tons/year and the project will be completed in 2011. The purpose of the demonstration is to determine if the NRCS EQIP can be successfully implemented on the Navajo Reservation. This lateral provides water to about 167 acres of irrigated land consisting of 12 separate parcels. Successful implementation of land leveling and installation of gated pipe would result in an estimated salt savings of 384 tons/year. Combined cost effectiveness of this project is about $43/ton. The majority of the habitat replacement work was completed in 2010 and construction of the salinity features was completed in the spring of 2011. This project is substantially complete and delivered water for the 2011irrigation season.

Funding Opportunity Announcement (FOA)

Reclamation released a FOA September 1, 2010, and over 30 applications were received. An application review committee (ARC) was convened in January 2011 to review, evaluate, and rank the applications. Reclamation selected eleven applications totaling over $35 million to award agreements. These agreements will be executed with irrigation companies in Colorado, Utah, and Wyoming to fund salinity control projects within the Upper Colorado River Basin. Eight of these agreements will be funded under the Basinwide Program, comprised of appropriations and cost-share funds from the Upper and Lower Colorado River Basin Funds (Basin Funds). Three of the agreements will be funded under the BSP with all the funds coming from the Basin Funds. A summary of the agreements executed will be provided in the Summary Chapter at the end of the FAR. Once completed it is estimated that the projects will help to control about 36,700 tons of salt loading annually that would otherwise enter the Colorado River system.

Paradox Valley Unit, Colorado

This project intercepts extremely saline brine (260,000 mg/l total dissolved solids) before it reaches the Dolores River and disposes of the brine by deep well injection (injection interval about 14,000 feet below ground surface). Seismicity associated with the injection process has diminished since the injection rate reduction in FY 2000 and remains at a low frequency and magnitude.

The project continues to intercept and dispose of 100,000+ tons of salt annually. The pressure necessary to inject the brine into the disposal formation at 14,000 feet is increasing (Table 7). Modification of the facility to operate at a higher injection pressure to extend the life of the injection

well was completed in 2009, but at the current rate of injection pressure increase, the current maximum pressure limit will be reached in 3 to 4 years or sooner. The Underground Injection Control (UIC) permit for the existing injection well was renewed in 2011 by EPA for another 10-year period. Reclamation initiated a Plan of Study to investigate the feasibility of other salt reduction alternatives to augment the project, including a second injection well. As part of the Plan of Study, an investigation of alternative salinity control methods was completed in June, 2008. The results of the investigation indicated a need for a current characterization of the regional groundwater flow to determine the appropriate strategy for future salinity control efforts. An interagency agreement was initiated with the USGS to conduct a hydro geologic study, and investigations for Phase I of the study began in the second quarter of FY 2009.
Phase I was essentially completed in the third quarter of FY 2010, resulting in a preliminary conceptual flow model of groundwater flow in the stream-aquifer system in the Paradox Valley. The model indicated that alternatives to reduce the amount of brine being produced, identified in the 2008 investigation is not feasible. As a result, Phase II of the study was not implemented.

At the request of the Salinity Control Forum, Reclamation began exploring and development of a pilot study to evaluate evaporation ponds as a viable method for salt disposal at Paradox. In 2011, Reclamation has had numerous meetings and discussion with the Bureau of Land Management, Fish and Wildlife Service, Environmental Protection Agency, and Colorado Department of Public Health and Environment. Major issues include compliance with the Migratory Bird Treaty Act, permitting requirements for disposal of the brine evaporate and pond liner, and high levels of hydrogen sulfide. Initial cost estimates for a 2 to 3 year pilot study using a 16 acre site are between $5 and $7 million depending on the site selected and environmental regulatory requirements. An additional $1.5 million would be required to encapsulate the pond at the completion of the study. Reclamation continues to work to find a suitable site for the pilot study and refine cost estimates. Projected completion schedule for constructing the pilot evaporation pond is 2014 or 2015 depending on the need to obtain a land withdrawal from the Bureau of Land Management.

Table 6 – Paradox Well Injection Evaluation

Injection Period	Operational Days[1]	Pressure Start	High Pressure During Period	Injection Period Net Pressure Change	Tons of Salt Injected[2]	No. of Induced Seismic Events	Maximum Magnitude of Induced Seismic Events	Estimated Tons of Salt Entering the River[3]
Jan-May '02[4]	148	1609	4432		52,860	25	2.9	8,469
June-Dec '02[5]	178	929	4593	161	58,953	34	2.2	8,333
Jan-May '03[5]	144	1172	4627	34	53,173	27	2.1	18,037
June-Dec '03[5]	184	1154	4675	48	59,530	106	2.3	11,185
Jan-May '04[6]	140	1201	4640	-35	51,449	47	2.4	20,225
June-Dec '04[7]	160	1091	4541	-99	51,589	57	3.9	6,442
Jan-May '05[5]	140	1038	4736	195	55,024	69	2.4	14,011
June-Dec '05[8]	148	1203	4750	14	46,551	31	2.6	38,582
Jan-June '06[9]	138	375	4680	-70	44,779	10[10]	2.4	53,039
July-Dec '06[5]	162	1084	4797	117	56,920	13[10]	2.1	18,605
Jan-June '07[5]	159	1066	4796	-1	56,068	7[10]	1.1	19,728
July-Dec '07[5]	163	1232	4712	-84	57,395	31	2.6	11,279
Jan-June '08[11]	160	1152	4813	101	54,720	47	1.3	15,305
July-Dec '08[5]	162	1263	4822	9	56,734	61	2.1	16,378
*Jan-Mar '09[5]	84	1246	4756	-66	29,163	20	2.6	22,029
Apr-Sept '09[12]	160	1157	4891	135	55,083	70	2.7	16,507
Oct '09-Mar '10[5]	153	970	4930	39	51,589	91	2.9	32,876
Apr '10-Sep '10[5]	162	1347	4990	60	55,747	75	2.7	17,223
Oct '10-Mar '11[5]	161	1378	5000	10	55,501	43	2.9	22,916
Apr '11-Sep '11[13]	158	1276	5102	102	54,422	63	2.7	11,591

---

1 Operational days include partial days of operation which accounts for variations in tons of salt injected
2 Tons of salt injected based on 260,000 mg/L. Brine concentration varies slightly due to seasonal and environmental fluctuations.
3 Tons of salt entering the river based on regression equations (Ken Watts, USGS Administrative Report – "Estimates of Dissolved Solids Load of the Dolores River in Paradox Valley, Montrose County, CO, 1988-2009, August 5, 2010"). The 2010 FAR contained erroneous estimated tons of salt entering the river.
4 Begin 100% brine injection
5 No problems
6 Down from 3/1/04 through 3/7/04 for mechanical problems
7 Implemented quarterly 10-day shutdown schedule from 9/22 to 10/22; M3.9 earthquake on 11/7; plant shut down until 11/18; discontinued 10-day shutdown schedule
8 Down from 11/13/05 through 12/31/05 for mechanical problems
9 Down from 1/1/06 through 1/19/06 and 2/16/06 through 3/2/06 for mechanical problems
10 Seismic data for 2006 and the first half of 2007 is likely incomplete due to seismic network problems
10 Seismic data for 2006 and the first half of 2007 is likely incomplete due to seismic network problems
10 Seismic data for 2006 and the first half of 2007 is likely incomplete due to seismic network problems
11 Down from 4/16-17/08 for mechanical problems
12 Down from 5/18-19/09 for mechanical problems
13 Down from 9/18-9/20 for communication link failure.

* Biannual shutdown schedule changed from winter/summer to spring/fall

Parallel Program

Section 205 of the Act authorizes Reclamation to expend amounts from the Basin Funds to repay the Treasury the reimbursable cost allocation of salinity projects or provide a cost share amount. This includes appropriations expended by the NRCS in their salinity program. The NRCS has questioned its ability to accept Basin Funds for cost sharing directly into its salinity program. Rather than repay the Treasury, the Colorado River Basin States (Basin States), NRCS, and Reclamation developed a "Parallel Program" (PP). Cost share funds from the Basin Funds have been used to accelerate and supplement implementation of the NRCS salinity measures by funding – through state agencies in Colorado, Utah, and Wyoming – salinity control measures that are separate, but parallel to, the salinity control measures implemented by the NRCS. Reclamation, with recommendations from the Basin States, had interpreted the Act to allow funds from the Basin Funds to be expended in the PP to further the general purposes of the Act.

To clarify authority for the administration of the PP, the Basin States prepared and put forth legislation through then-Senator Salazar's office into the 2008 Farm Bill to amend the Act that has now created the Basin States Program (BSP). Public Law 110-246 amended the Act and established the BSP. The BSP is explained in more detail later in the report.

With the creation of the BSP, the PP is in the process of being phased out and all funds not used in the PP will become part of the BSP. As of October 15, 2010, the state agencies are no longer authorized to enter into contracts under the PP. Contracts that the state agencies have executed must have all practices installed, constructed, or implemented by September 30, 2012, in order to receive reimbursement. The state agencies may request reimbursement from Reclamation until December 30, 2012.

Utah Department of Agriculture and Food (UDAF)

During FY 2011, UDAF, with the assistance of two field technicians, has been successful in closing several Parallel Salinity Control Program projects. The table below summarizes UDAF's efforts in closing out the Parallel salinity funds within three designated salinity areas. During this period no Basin State Program dollars were obligated as work to complete a cooperative agreement with Reclamation and UDAF was the major focus as this new program starts.

In the Uintah Basin one contract was closed with payments made to two others, totaling $38,777. There remain fifteen open contracts totaling $1,984,763 in this area. Of this almost two million dollars, $1.8 million is for the Hancock Cove pipeline that will be completed before early spring 2012. This leaves less than $150,000 to be paid out in unfinished Parallel contracts in the Uintah Basin salinity control area.

Six contracts were completed in the Price San Rafael area with payments made to nineteen others, totaling just over $1.5 million. There remain thirty-four open contracts totaling just over $300,000. Most of these contracts are on schedule for completion and final payments this fall and next summer upon implementation of the irrigation water management (IWM) requirements. IWM is the proper application of water to meet crop needs and minimize deep percolation thus decreasing salt loading. It is a conservation practice of all financially assisted on-farm salinity control programs.

One payment of $1,784 was made to a producer in the Manila area for irrigation water management during this fiscal year. $2,864 remains to be paid to three producers in this area for irrigation water management. This will close all the contracts in the Manila area by September 2012.

The following table summarizes this year's activities associated with the closing of the Parallel Program. UDAF has been able to obligate $10,867,302 of available $10,962,186 in the Parallel Program. UDAF has paid out $8,557,411 in salinity control projects in three of Utah's five salinity control areas and has $2,309,892 left to pay out. UDAF is confident that it will be able to complete the remaining fifty-three projects before September of 2012 closing out UDAF's portion of the Parallel Program. With the completion of the remaining projects, 48,058 tons of salt will be controlled annually through the Parallel Program in Utah.

Area	$'s Paid Out 2010-2011	Number of Contracts	Contracts Completed	Contracts Remaining	**Obligated** $'s Remaining
Uintah Basin	$38,777	3	1	15	$1,984,763
Price San Rafael	$1,521,726	19	6	34	$322,265
Manila	$1,784	1	0	3	$2,864
Totals	$1,562,287	23	7	52	$2,309,892

UDAF uses Technical Assistance funds to contract with the Utah Association of Conservation Districts to employ two full-time salinity planners – one each in the Uintah Basin and Price San Rafael salinity areas. These funds are also used to employ an environmental scientist to assist with data management, contract review, and project consulting.

As Utah completes treatment of surface irrigation systems, new opportunities for salt control will be explored. The next largest contributor to salt is the desert rangeland. UDAF has an entire section devoted to rangeland improvement. With this expertise UDAF has been funded with Special Project funds to conduct a ten year study to evaluate the effectiveness of rangeland treatments on salinity control. This past year UDAF has entered into a contract with a large ranch in Emery County, Utah to assist in demonstrating the effectiveness of rangeland treatments. UDAF has installed weather stations, developed specialized soil probes for measuring in situ soil EC (electrical conductivity) and moisture levels, and collected one series of electro-magnetic inductance reading for the project area. Soil samples have also been collected and analyzed to add to a comprehensive collection of pretreatment data.

Colorado State Conservation Board (CSCB)

The Basin States Parallel Program (BSPP) in Colorado is delivered by six local conservation districts that subtend the boundaries of the approved salinity control areas in the State of Colorado. These salinity control areas include the Silt Mesa, Grand Valley, Lower Gunnison, McElmo, and Mancos salinity areas. The Bookcliff, Mesa, Delta, Shavano, Dolores, and Mancos Conservation Districts receive funds from the Colorado State Conservation Board (CSCB) that in turn receives funding based upon a contract agreement with Reclamation. The districts enter into contract agreements with individual landowners and entities to install approved salinity control projects and/or wildlife replacement projects within salinity control area boundaries. The projects were planned, designed, and certified by NRCS or district employees. These employees were paid through BSPP funding earned by the NRCS and reserved for use by the Conservation Districts. All projects were planned,

designed, and certified based upon current NRCS Standards and Specifications. Each participant signed an operation and maintenance agreement to remain in effect for the life of the irrigation improvements installed. Each participant was also required to perform proper Irrigation Water Management on the fields in which irrigation improvements were installed. Participants receive a financial incentive for performing Irrigation Water Management. The Colorado BSPP follows planning and contracting procedures in place for the Environmental Quality Incentives Program (EQIP). The BSPP in Colorado is utilized:

To fund projects that do not meet all EQIP eligibility requirements
To fund group or off-farm entities that were not eligible or too complex to be implemented through EQIP
To fund projects when there were insufficient funds available through EQIP.

The projects were planned and contracted using the current NRCS EQIP payment schedule. Applications were received on a continuous basis, and were selected for funding as current year funding was made available from Reclamation and based upon EQIP funds obligated. The applications were competitively screened and prepared by the NRCS.

Applications were funded by district in order of the best cost effectiveness. All applications meeting NRCS planning standards that result in an annualized cost per ton of less than $60 and that were also not eligible for EQIP were considered for funding depending upon funds available. The cost effectiveness and salt loading data used for these calculations were standardized for all salinity control areas in the State of Colorado by the NRCS. The local conservation district recommended and referred the application for approval to the Colorado BSPP coordinator. Upon approval of the application, the district entered into a contract with the applicant for the irrigation and/or wildlife improvements based on the current NRCS payment rate. Upon completion of the project, the NRCS eertifies the installation, and the district provides a payment to the landowner or entity. Colorado provides payment and periodically requests reimbursement from Reclamation for these payments.

No new contracts or projects have been accepted for FY 2011, as the Basin States Parallel Program is closed for new projects.

Progress:

250 contracts have been written for participants to date for payment in the current contract between Reclamation and the State of Colorado. This represents a total financial assistance obligation of $11,709,755. When these contracts are complete, participants will have installed salinity control measures on 11,553 acres of irrigated land, resulting in 26,519 tons of salt reduction at an average eost effectiveness of approx. $54.00/Ton. 235 of the 250 partieipants have installed at least one salinity control project. $9,114,407 in payments were made to participants for these improvements. The remaining active contracts include a larger lateral project in the Lower Gunnison area, with an estimated cost of $1,500,000 that will be completed by April, 2012.

11 of the 250 contracts in place were wildlife-only contracts that will result in 557.2 acres of wildlife habitat replacement for a total payment of approx. $500,476.00. Each of the wildlife project participants has installed at least some improvements to date, improving and/or replacing 318.8 acres of wildlife. We anticipate that there will be no eancellations of the remaining wildlife projects.

As the BSPP will officially end Dec. 31, 2012, all active contracts must be completed and paid by that date.

Plateau Valley Pilot Project: The Plateau Valley Pilot Project (PVPP) began in 2009 to provide incentives for salinity control proportional to the value of benefits derived, and identify and quantify acres of irrigation improvements that may be credited to NRCS salinity control activities as a result of the implementation of general EQIP funding in the PVPP area. Funding has been reserved for the PVPP in the contract with Reclamation and the Colorado State Conservation Board. Colorado has a contract agreement in place with the DeBeque-Plateau Valley Conservation District to deliver these funds. The NRCS provides technical planning, design, and construction inspection assistance for planned practices, and develops conservation plans for applicants in the PVPP area. The NRCS develops General EQIP program contracts with applicants in the target area. The contracts include an Operation and Maintenance provision, and payment for basic Irrigation Water Management or an enhanced Irrigation Water Management level at the option of the participant. The program to date has expended $56,085.00, resulting in installation of 477 acres of sprinklers and 102 acres of gated pipeline. The corresponding EQIP participation in the program is $712,953.00. There were no new incentive contracts written for FY 2011, as the BSPP is closed for new projects.

Basin States Program

The BSP is to be implemented by the Secretary through Reclamation. Amounts from the Basin Funds used for cost sharing, not just those associated with the NRCS salinity program, will now be administered through the BSP.

The Act requires a planning report to be submitted to Congress 30 days before Reclamation implements the BSP. The final Planning Report sent by the Secretary, was received by Congress on Monday, September 14, 2009. Reclamation, in consultation with the Basin States, has begun to implement the BSP to replace the PP on October 1, 2010. Interagency agreements have been executed with the NRCS in the states of Colorado and Utah to provide the technical assistance for the BSP. Cooperative agreements have been prepared by Reclamation and reviewed by the state agencies. The cooperative agreements are expected to be executed with the state agencies in October 2011.

This page intentionally left blank.

Summary Data
Colorado River Basin Salinity Control Program

The following tables are summaries of the Federal Salinity Control Programs.

Summary of Federal Salinity Control Programs
FY 2011

Salinity Unit		Tons / Year Removed
MEASURES IN PLACE BY RECLAMATION		
Basinwide Program		206,600
Basin States Program (BSP)	1/	12,200
Meeker Dome		48,000
Las Vegas Wash Pitman		3,800
Grand Valley		122,300
Paradox Valley	2/	110,000
Lower Gunnison Winter Water (USBR)		41,400
Dolores		23,000
Reclamation Subtotal		**567,000**
MEASURES IN PLACE BY USDA/BSP	3/	
Grand Valley		147,300
Price-San Rafael		84,300
Uinta Basin		145,900
Big Sandy River		56,800
Lower Gunnison		110,300
McElmo Creek		27,400
Mancos		4,200
Muddy Creek		100
Manila		8,000
Silt		3,700
Green River		200
Tier 2	4/	3,800
USDA Subtotal		**588,000**
MEASURES IN PLACE BY BLM		
Nonpoint Sources	5/	111,600
Well-Plugging		14,600
BLM Subtotal		**126,000**
Measures in Place Total		**1,281,000**
GOALS TO REACH TARGET		
Reclamation Basinwide Program		336,900
Price-San Rafael (USDA/BSP)		62,600
Grand Valley (USDA/BSP)	6/	0
Uinta Basin (USDA/BSP)	7/	11,500
Big Sandy River (USDA/BSP)		26,900
Lower Gunnison (USDA/BSP)		75,700
McElmo Creek (USDA/BSP)		18,600
Mancos River (USDA/BSP)		7,700
Muddy Creek (USDA/BSP)		11,600
Manila (USDA/BSP)		9,500
Silt (USDA/BSP)	6/	300
Green River (USDA/BSP)		6,400
Tier 2 (USDA)	4/	16,200
New Well Plugging and Nonpoint Source (BLM)		0
Goals Subtotal		**584,000**
Total (Measures in Place + Goals)		**1,865,000**
Target by 2030		**1,850,000**

1/ Off-farm projects funded by Basin States Program
2/ Paradox injection well capacity estimated to decline beginning in 2020; assumed continuation of well or alternative control methods after 2020
3/ May include off-farm controls that were not goaled.
4/ Measures in areas outside approved projects
5/ BLM non-point source are estimates.
6/ Original goal attained
7/ Estimated; original goal attained.

COLORADO RIVER BASIN SALINITY CONTROL PROGRAM TITLE II

Actual Appropriations and Payments from the Basin Funds 1996 thru 2011

9/30/2011

TOTAL PROGRAM ($1,000)

Unit	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Subtotal	2012	2013	2014	2015
Grand Valley O&M	0	0	3,755	1,363	1,709	685	1,293	1,128	961	700	1,491	1,340	1,228	1,761	1,574	1,889	20,877	1,889	1,889	1,889	1,889
Paradox Valley O&M	0	0	1,375	2,032	4,169	2,016	2,685	2,123	2,461	2,019	2,415	2,668	3,212	3,119	3,670	3,776	37,740	2,932	2,932	2,932	2,932
Lower Gunnison O&M	0	0	401	455	599	331	321	0	0	0	0	0	0	0	0	0	2,107	0	0	0	0
McElmo Creek (Dolores) O&M	0	0	405	471	523	313	385	433	474	467	671	459	576	595	747	493	7,012	876	876	876	876
USBR Basinwide Program	500	6,333	10,858	16,783	21,459	11,891	15,885	12,427	13,090	10,755	12,540	13,870	11,401	25,091	10,863	11,504	204,750	10,000	10,000	10,000	10,000
Subtotal (USBR Program)	500	6,333	16,794	21,104	28,459	15,236	20,569	16,111	16,986	13,941	17,117	18,337	16,417	30,566	16,854	17,662	272,987	15,697	15,697	15,697	15,697
USDA Program	0	4,428	4,155	5,995	8,355	5,785	13,022	19,763	27,975	25,681	28,962	28,238	25,008	25,949	20,996	25,216	269,527	24,286	24,286	22,857	22,857
BLM (no Basin Funds)	800	800	800	800	800	800	800	800	800	800	751	800	800	800	800	800	12,751	800	800	800	800
Total	1,300	11,561	21,749	27,899	37,614	21,821	34,391	36,674	45,761	40,422	46,830	47,375	42,225	57,315	38,650	43,678	555,265	40,783	40,783	39,354	39,354

APPROPRIATIONS EXPENDED ($1,000)

Unit	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Subtotal	2012	2013	2014	2015
Grand Valley O&M	0	0	2,525	1,144	1,172	685	993	885	739	668	1,125	1,007	876	1,320	1,102	1,417	15,658	1,417	1,417	1,417	1,417
Paradox Valley O&M	0	0	1,375	1,307	2,751	2,016	2,027	1,516	1,780	1,918	1,827	1,975	2,378	2,341	2,824	2,832	28,867	2,199	2,199	2,199	2,199
Lower Gunnison O&M	0	0	401	319	320	331	179	0	0	0	0	0	0	0	0	0	1,550				
McElmo Creek (Dolores) O&M	0	0	405	340	350	313	247	366	343	445	527	293	392	421	485	345	5,272	613	613	613	613
USBR Basinwide Program	500	3,464	7,600	12,541	12,044	10,791	11,498	8,548	9,547	8,270	8,474	8,948	7,984	17,281	7,604	8,053	143,147	7,000	7,000	7,000	7,000
Subtotal (USBR Program)	500	3,464	12,306	15,651	16,637	14,136	14,944	11,315	12,409	11,301	11,953	12,223	11,630	21,363	12,015	12,647	194,494	11,229	11,229	11,229	11,229
USDA Program	0	3,100	2,894	4,016	3,805	5,785	10,451	12,714	19,488	19,798	19,661	19,667	17,611	18,551	14,697	17,651	189,889	17,000	17,000	16,000	16,000
Total	500	6,564	15,200	19,667	20,442	19,921	25,395	24,029	31,897	31,099	31,614	31,890	29,241	39,914	26,712	30,298	384,383	28,229	28,229	27,229	27,229

UPPER BASIN FUND COST SHARE PAYMENTS ($1,000)

Unit	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Subtotal	2012	2013	2014	2015
Grand Valley O&M	0	0	184	33	91	0	45	20	33	32	55	50	44	68	71	71	797	71	71	71	71
Paradox Valley O&M	0	0	0	109	208	0	99	49	102	101	88	104	134	115	139	142	1,390	110	110	110	110
Lower Gunnison O&M	0	0	0	20	42	0	21	0	0	0	0	0	0	0	0	0	83				
McElmo Creek (Dolores) O&M	0	0	0	20	26	0	21	5	20	22	22	25	25	20	39	22	267	39	39	39	39
USBR Basinwide Program	0	446	489	739	1,540	0	658	314	531	531	615	1,676	513	1,052	489	518	10,111	450	450	450	450
Subtotal (USBR Program)	0	446	673	921	1,907	0	844	388	686	686	780	1,855	716	1,255	738	752	12,647	670	670	670	670
USDA Projects	0	199	189	296	682	0	386	572	1,274	1,256	1,286	1,286	1,132	1,145	945	1,135	11,783	1,093	1,093	1,029	1,029
Total Payment	0	645	862	1,217	2,589	0	1,230	960	1,960	1,942	2,066	3,141	1,848	2,400	1,683	1,887	24,430	1,763	1,763	1,699	1,699

LOWER BASIN FUND COST SHARE PAYMENTS ($1,000)

Unit	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Subtotal	2012	2013	2014	2015
Grand Valley O&M	0	0	1,046	186	446	0	255	223	189	0	311	283	308	373	401	401	4,422	401	401	401	401
Paradox Valley O&M	0	0	0	616	1,210	0	559	558	579	0	500	589	700	663	707	802	7,483	623	623	623	623
Lower Gunnison O&M	0	0	0	116	237	0	121	0	0	0	0	0	0	0	0	0	474				
McElmo Creek (Dolores) O&M	0	0	0	111	147	0	117	62	111	0	122	141	159	154	223	126	1,473	223	223	223	223
USBR Basinwide Program	0	2,423	2,769	3,503	7,875	1,100	3,729	3,565	3,012	1,954	3,451	3,246	2,904	6,758	2,770	2,934	51,993	2,550	2,550	2,550	2,550
Subtotal (USBR Program)	0	2,423	3,815	4,532	9,915	1,100	4,781	4,408	3,891	1,954	4,384	4,259	4,071	7,948	4,101	4,263	65,845	3,798	3,798	3,798	3,798
USDA Projects	0	1,129	1,072	1,683	3,868	0	2,185	6,477	7,213	4,627	8,015	7,285	6,265	6,253	5,354	6,430	67,856	6,193	6,193	5,829	5,829
Total	0	3,552	4,887	6,215	13,783	1,100	6,966	10,885	11,104	6,581	12,399	11,544	10,336	14,201	9,455	10,693	133,701	9,991	9,991	9,626	9,626

COLORADO RIVER BASIN SALINITY CONTROL PROGRAM TITLE II

Upper Colorado River Basin Fund

As of 9/30/2011

A	B	C	D	E	F	G	H	I	J
	Up-front Cost Sharing								
Fiscal Year	Paradox Valley O&M	Grand Valley O&M	McElmo Creek (Dolores) O&M	Lower Gunnison O&M	Basinwide SCP	USDA NRCS SCP	**Total Transfer to UC Region**	**Total Repayment Transfer to Treasury**	**Total Annual Requirement**
1987								6,918	6,918
1988								90,088	90,088
1989								110,531	110,531
1990								156,936	156,936
1991								200,047	200,047
1992								301,475	301,475
1993								451,325	451,325
1994								357,687	357,687
1995								1,934,454	1,934,454
1996								2,750,148	2,750,148
1997					446,000	199,000	645,000	285,643	930,643
1998		184,000			489,000	189,000	862,000	135,666	997,666
1999	109,000	33,000	20,000	20,000	739,000	296,000	1,217,000	87,604	1,304,604
2000	206,000	91,000	26,000	42,000	1,540,000	682,000	2,587,000	0	2,587,000
2001	0	0	0	0	0	0	0	0	0
2002	99,000	45,000	21,000	21,000	658,000	386,000	1,230,000	0	1,230,000
2003	49,000	20,000	5,000		314,000	572,000	960,000	0	960,000
2004	102,000	33,000	20,000		531,000	1,274,000	1,960,000	0	1,960,000
2005	101,000	32,000	22,000		531,000	1,256,000	1,942,000	0	1,942,000
2006	88,000	55,000	22,000		607,000	1,416,000	2,188,000	0	2,188,000
2007	104,000	50,000	25,000		1,676,000 1/	1,286,000	3,141,000 2/	0	3,141,000
2008	134,000	44,000	25,000		513,000	1,106,000	1,822,000	0	1,822,000
2009	115,000	68,000	20,000		1,052,000	1,145,000	2,400,000	0	2,400,000
2010	138,540	70,850	39,407		488,829	1,192,592	1,930,218	0	1,930,218
2011	141,594	51,928	22,178		517,695	958,337	1,691,732	0	1,691,732
Subtotal	1,387,134	777,778	267,585	83,000	10,102,524 0	11,957,929	24,575,950	6,868,522	31,444,472
2012	138,540	70,850	39,407		488,829	1,029,000	1,766,626	0	1,766,626
2013	138,540	70,850	39,407		488,829	964,000	1,701,626	0	1,701,626
2014	138,540	70,850	39,407		488,829	900,000	1,637,626	0	1,637,626
2015	138,540	70,850	39,407		488,829	900,000	1,637,626	0	1,637,626
2016	138,540	70,850	39,407		488,829	836,000	1,573,626	0	1,573,626
2017	138,540	70,850	39,407		488,829	771,000	1,508,626	0	1,508,626
2018	138,540	70,850	39,407		488,829	771,000	1,508,626	0	1,508,626
2019	138,540	70,850	39,407		488,829	707,000	1,444,626	0	1,444,626
2020	138,540	70,850	39,407		488,829	643,000	1,380,626	0	1,380,626
2021	138,540	70,850	39,407		488,829	643,000	1,380,626	0	1,380,626
2022	138,540	70,850	39,407		488,829	643,000	1,380,626	0	1,380,626
2023	138,540	70,850	39,407		488,829	643,000	1,380,626	0	1,380,626
2024	138,540	70,850	39,407		488,829	643,000	1,380,626	0	1,380,626
2025	138,540	70,850	39,407		488,829	643,000	1,380,626	0	1,380,626
2026	138,540	70,850	39,407		488,829	643,000	248,797	1,384,314	1,633,111
2027	138,540	70,850	39,407		488,829	643,000	248,797	0	248,797
2028	138,540	70,850	39,407		488,829	643,000	248,797	0	248,797
2029	138,540	70,850	39,407		488,829	643,000	248,797	0	248,797
2030	138,540	70,850	39,407		488,829	643,000	248,797	0	248,797
2031	138,540	70,850	39,407				248,797	0	248,797
2032	138,540	70,850	39,407				248,797	0	248,797
2033	138,540	70,850	39,407				248,797	0	248,797
2034	138,540	70,850	39,407				248,797	0	248,797
2035	138,540	70,850	39,407				248,797	0	248,797
2036	138,540	70,850	39,407				248,797	0	248,797
2037	138,540	70,850	39,407				248,797	0	248,797
2038	138,540	70,850	39,407				248,797	0	248,797
2039	138,540	70,850	39,407				248,797	3,200,008	3,448,805
2040	138,540	70,850	39,407				248,797	64,747	313,544
2041	138,540	70,850	39,407				248,797	0	248,797
2042	138,540	70,850	39,407				248,797	347,605	596,402
2043	138,540	70,850	39,407				248,797	158,454	407,251
2044	138,540	70,850	39,407				248,797	0	248,797
2045	138,540	70,850	39,407				248,797	0	248,797
2046	138,540	70,850	39,407				248,797	1,071,189	1,319,986
2047	138,540	70,850	39,407				248,797	1,919,584	2,168,381
2048	138,540	70,850	39,407				248,797	0	248,797
Total	6,513,114	3,399,228	1,725,644	83,000	19,390,275 0	25,908,929	51,361,045	15,014,423	66,126,671

The total amount was accounted for in the Basinwide Program portion.

2/ The actual amount transferred from the Upper Basin Fund to the UC Region for the Salinity Program was $2,038,000, of which $573,000 was for the Basinwide Program. Please see footnote 1/ for the explanation of the difference.

$573,000 was for the Basinwide Program. Please see footnote 1/ for the explanation of the difference.

COLORADO RIVER BASIN SALINITY CONTROL PROGRAM TITLE II

Upper Colorado River Basin Fund

As of 9/30/2011

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
	Repayment																		
				Grand Valley															
	Paradox Valley Unit			Construction Completed								Las Vegas	Lower Gunnison		McElmo Creek (Dolores Project)			Total	
Fiscal Year	Well	Facilities	O&M	Sep-89	Sep-92	Sep-93	Sep-97	Sep-98	Sep-99	Total	O&M	Wash	Construction	O&M	Construction	O&M	USDA NRCS	Transfer to Treasury	Year
1987											2,013						4,905	6,918	1987
1988			973								2,545						86,570	90,088	1988
1989			4,454								914						105,163	110,531	1989
1990			7,190								3,675						146,071	156,936	1990
1991			9,659								4,317						183,802	200,047	1991
1992			17,701								4,418			10,301		2,269	266,734	301,475	1992
1993			16,011								11,012			11,000		2,321	408,072	451,325	1993
1994			18,457								2,152			15,865		5,230	319,296	357,687	1994
1995			29,749								14,647		1,405,078	16,021		1,917	460,114	1,934,454	1995
1996			90,326								24,860		-7,680	18,525	2,464,892	8,845	145,568	2,750,148	1996
1997			80,337								22,645		675	18,774	21,829	13,657	128,770	285,643	1997
1998			70,676								18,704		-43	19,188	10,658	12,613		135,666	1998
1999													59,331		28,273	16,483		87,604	1999
2000																		0	2000
2001																		0	2001
2002																		0	2002
2003																		0	2003
2004																		0	2004
2005																		0	2005
2006																		0	2006
2007																		0	2007
2008																		0	2008
2009																		0	2009
2010																		0	2010
2011																		0	2011
Subtotal	0	0	345,533	0	0	0	0	0	0	0	111,902	0	1,457,361	109,674	2,525,652	63,335	2,255,065	6,868,522	
2012	0	0		0	0	0	0	0	0	0								0	2012
2013	0	0		0	0	0	0	0	0	0								0	2013
2014	0	0		0	0	0	0	0	0	0								0	2014
2015	0	0		0	0	0	0	0	0	0								0	2015
2016	0	0		0	0	0	0	0	0	0								0	2016
2017	0	0		0	0	0	0	0	0	0								0	2017
2018	0	0		0	0	0	0	0	0	0								0	2018
2019	0	0		0	0	0	0	0	0	0								0	2019
2020	0	0		0	0	0	0	0	0	0								0	2020
2021	0	0		0	0	0	0	0	0	0								0	2021
2022	0	0		0	0	0	0	0	0	0								0	2022
2023	0	0		0	0	0	0	0	0	0								0	2023
2024	0	0		0	0	0	0	0	0	0								0	2024
2025	0	0		0	0	0	0	0	0	0								0	2025
2026	1,402,063	0		0	0	0	0	0	0	0			-421		-17,328			1,384,314	2026
2027		0		0	0	0	0	0	0	0								0	2027
2028		0		0	0	0	0	0	0	0								0	2028
2029		0		0	0	0	0	0	0	0								0	2029
2030		0		0	0	0	0	0	0	0								0	2030
2031		0		0	0	0	0	0	0	0								0	2031
2032		0		0	0	0	0	0	0	0								0	2032
2033		0		0	0	0	0	0	0	0								0	2033
2034		0		0	0	0	0	0	0	0								0	2034
2035		0		0	0	0	0	0	0	0								0	2035
2036		0		0	0	0	0	0	0	0								0	2036
2037		0		0	0	0	0	0	0	0								0	2037
2038		0		0	0	0	0	0	0	0								0	2038
2039		0		3,200,008	0	0	0	0	0	3,200,008								3,200,008	2039
2040		0			0	0	0	0	0	0		64,747						64,747	2040
2041		0			0	0	0	0	0	0								0	2041
2042		0			347,605	0	0	0	0	347,605								347,605	2042
2043		0				158,454	0	0	0	158,454								158,454	2043
2044		0					0	0	0	0								0	2044
2045		0					0	0	0	0								0	2045
2046		1,071,189					0	0	0	0								1,071,189	2046
2047							209,719	1,059,717	650,148	1,919,584								1,919,584	2047
2048										0									2048
Total	1,402,063	1,071,189	345,533	3,200,008	347,605	158,454	209,719	1,059,717	650,148	5,625,651	111,902	64,747	1,456,940	109,674	2,508,324	63,335	2,255,065	15,014,423	

LOWER COLORADO RIVER BASIN DEVELOPMENT FUND (LCRBDF)
SURCHARGE FUND STATUS (2 1/2 MILLS)

as of 9/30/11

	YEAR	A COLLECTIONS 1/	B COLLECTIONS 4/	C DEFICIENCY PAYMENTS 2/	D SALINITY TRANSFERS TO TREASURY 2/	E SALINITY PAYMENTS UC REGION 2/	(A + B - C - D - E) F CUMULATIVE BALANCE IN LCRBDF V42 FUNDS
	1987	1,540,704.99		0.00	0.00		1,540,704.99
	1988	9,359,325.00		1,532,868.00	56,609.00		9,310,552.99
	1989	8,442,385.00		1,532,868.00	671,012.00		15,549,057.99
	1990	8,899,347.50		1,532,868.00	967,576.00		21,947,961.49
	1991	8,055,137.50		11,532,868.00	2,424,156.00		16,046,074.99
	1992	7,622,747.50		1,532,868.00	3,341,252.00		18,794,702.49
	1993	6,960,422.50		1,532,868.00	5,502,160.00		18,720,096.99
	1994	8,830,220.00		1,532,868.00	7,853,582.00		18,163,866.99
	1995	8,212,818.42		1,532,868.00	5,833,699.00		19,010,118.41
	1996	9,644,684.16		1,532,868.00	4,575,630.00		22,546,304.57
	1997	9,172,878.54		1,532,868.00	1,370,282.00	3,552,000.00	25,264,033.11
	1998	10,398,523.94		1,532,868.00	2,279,925.00	4,887,000.00	26,962,764.05
	1999	10,908,408.29		730,073.25	1,180,267.00	6,215,000.00	29,745,832.09
	2000	10,410,325.45		0.00	1,034,975.00	13,783,000.00	25,338,182.54
3/	2001	10,255,846.46		0.00	1,034,975.00	1,100,000.00	33,459,054.00
	2002	8,674,271.24		0.00	1,029,973.00	6,966,000.00	34,137,352.24
	2003	8,202,776.78		0.00	1,032,474.00	10,885,000.00	30,422,655.02
	2004	8,307,425.37		0.00	1,032,474.00	11,104,000.00	26,593,606.39
	2005	6,700,765.00	448,360.43	0.00	1,032,474.00	6,581,000.00	26,129,257.82
	2006	8,174,032.50	1,462,304.76	0.00	4,901,904.00	12,399,000.00	18,464,691.08
	2007	8,008,372.50	1,418,251.90	0.00	779,905.00	11,544,000.00	15,567,410.48
	2008	7,842,785.00	1,478,286.68	0.00	419,593.00	10,336,000.00	14,132,889.16
5/	2009	7,574,720.00	1,547,287.68	0.00	997,172.00	0.00	22,257,724.84
6/	2010	7,201,522.50	1,519,804.85	0.00	997,172.00	5,475,213.00	24,506,667.19
	2011	7,846,225.00	1,593,620.74	0.00	997,172.00	14,237,779.00	18,711,561.93
	TOTALS	207,246,671.14	9,467,917.04	27,591,621.25	51,346,413.00	119,064,992.00	18,711,561.93

1/ Amounts collected into Colorado River Dam Fund and Transferred to LCRBDF

2/ Payments from LCRBDF

3/ Salinity payment for 2001 was estimated. A trueup was received in 2002 which was $2,501.00 less than was actually paid. Adjusted from 2002 estimate.

4/ Amounts collected into Parker Davis and Transferred to LCRBDF

5/ UC did not request any funds for cost-sharing due to existing & sufficient unliquidated obligations in place

6/ Includes prior year adj of $615.00

COLORADO RIVER BASIN SALINITY CONTROL PROGRAM TITLE II

Lower Colorado River Basin Development Fund

As of 9/30/11

A	B	C	D	E	F	G	H	I	J	K	N	P
					Up-front Cost Sharing							
	Revenues									**NRCS SCP Cost Share**		
Year	Hoover	Parker & Davis	**Deficiency Payments**	**Repayment Transfer to Treasury**	Paradox Valley O&M	Grand Valley O&M	McElmo Creek O&M	Lower Gunnison O&M	Basinwide SCP	Cost Share Earned NRCS SCP	**Actual and Projected Transfer to UC Region**	**Actual LCRBDF Balance Available**
1987	1,540,705											$ 1,540,705
1988	9,359,325		1,532,868	56,609								$ 9,310,553
1989	8,442,385		1,532,868	671,012								$ 15,549,058
1990	8,899,348		1,532,868	967,576								$ 21,947,962
1991	8,055,138		11,532,868	2,424,156								$ 16,046,075
1992	7,622,748		1,532,868	3,341,252								$ 18,794,703
1993	6,960,423		1,532,868	5,502,160								$ 18,720,097
1994	8,830,220		1,532,868	7,853,582								$ 18,163,867
1995	8,212,818		1,532,868	5,833,699								$ 19,010,118
1996	9,644,684		1,532,868	4,575,630								$ 22,546,305
1997	9,172,879		1,532,868	1,370,282					2,423,000	1,129,000	3,552,000	$ 25,264,033
1998	10,398,524		1,532,868	2,279,925		1,046,000			2,769,000	1,072,000	4,887,000	$ 26,962,764
1999	10,908,408		730,073	1,180,267	616,000	186,000	111,000	116,000	3,503,000	1,683,000	6,215,000	$ 29,745,832
2000	10,410,325			1,034,975	1,210,000	446,000	147,000	237,000	7,875,000	3,868,000	13,783,000	$ 25,338,183
2001	10,255,846			1,034,975	0	0	0	0	1,100,000	0	1,100,000	$ 33,459,054
2002	8,674,271			1,029,973	559,000	255,000	117,000	121,000	3,729,000	2,185,000	6,966,000	$ 34,137,353
2003	8,202,777			1,032,474	558,000	223,000	62,000		3,565,000	6,477,000	10,885,000	$ 30,422,655
2004	8,307,425			1,032,474	579,000	189,000	111,000		3,012,000	7,213,000	11,104,000	$ 26,593,607
2005	6,700,765	448,360		1,032,474	0	0	0		1,954,000	4,627,000	6,581,000	$ 26,129,258
2006	8,174,033	1,462,305		4,901,904	500,000	311,000	122,000		3,451,000	8,015,000	12,399,000	$ 18,464,691
2007	8,008,372	1,418,252		779,905	589,000	283,000	141,000		3,246,000	7,285,000	11,544,000	$ 15,567,410
2008	7,842,785	1,478,286		419,593	700,000	308,000	159,000		2,904,000	6,265,000	10,336,000	$ 14,132,888
2009	7,574,720	1,547,288		997,172	1/ 663,000	1/ 373,000	1/ 154,000		1/ 6,296,000	1/ 6,758,000	1/ 0	$ 22,257,725
2010	7,201,523	1,519,805		997,172	707,493	401,483	223,307		2,770,028	6,388,912	5,475,213	$ 24,506,668
2011	7,846,225	1,593,621		997,172	802,363	294,257	125,676		2,993,608	7,384,155	14,237,779	$ 18,711,563
Subtotal	207,246,671	9,467,916	27,591,621	51,346,413	7,483,856	4,315,740	1,472,983	474,000	51,590,636	70,350,067	119,084,992	
2012	7,500,000	1,500,000		997,172	802,363	294,257	125,676		5,253,000	6,557,000	15,300,000	$ 11,414,392
2013	7,500,000	1,500,000		997,172	802,363	294,257	125,676		5,482,000	5,828,000	8,023,241	$ 11,393,980
2014	7,500,000	1,500,000		997,172	802,363	294,257	125,676		5,709,000	5,465,000	8,588,570	$ 10,808,239
2015	7,500,000	1,500,000		997,172	802,363	294,257	125,676		6,052,000	5,100,000	8,928,488	$ 9,882,580
2016	7,500,000	1,500,000		997,172	700,000	350,000	150,000		6,395,000	4,735,000	8,500,000	$ 9,385,409
2017	7,500,000	1,500,000		997,172	700,000	350,000	150,000		6,737,000	4,372,000	8,500,000	$ 8,888,237
2018	7,500,000	1,500,000		997,172	700,000	350,000	150,000		7,080,000	3,643,000	8,500,000	$ 8,391,066
2019	7,500,000	1,500,000		997,172	700,000	350,000	150,000		7,423,000	3,643,000	8,500,000	$ 7,893,895
2020	7,500,000	1,500,000		997,172	700,000	350,000	150,000		7,765,000	3,643,000	8,500,000	$ 7,396,724
2021	7,500,000	1,500,000		997,172	700,000	350,000	150,000		8,108,000	3,643,000	8,500,000	$ 6,899,553
2022	7,500,000	1,500,000		997,172	700,000	350,000	150,000		8,565,000	3,643,000	8,500,000	$ 6,402,382
2023	7,500,000	1,500,000		997,172	700,000	350,000	150,000		9,021,000	3,643,000	8,500,000	$ 5,905,211
2024	7,500,000	1,500,000		997,172	700,000	350,000	150,000		9,478,000	3,643,000	8,500,000	$ 5,408,039
2025	7,500,000	1,500,000		997,172	700,000	350,000	150,000		9,935,000	3,643,000	8,500,000	$ 4,910,868
2026	7,500,000	1,500,000		997,174	700,000	350,000	150,000		10,000,000	3,643,000	9,000,000	$ 3,913,695
2027	7,500,000	1,500,000		732,692	700,000	350,000	150,000		12,000,000	3,643,000	9,000,000	$ 3,181,004
2028	7,500,000	1,500,000		732,692	700,000	350,000	150,000		13,500,000	3,643,000	9,000,000	$ 2,448,313
2029	7,500,000	1,500,000		732,692	700,000	350,000	150,000		14,000,000	3,643,000	9,000,000	$ 1,715,622
2030	7,500,000	1,500,000		732,692	700,000	350,000	150,000		15,000,000	3,643,000	9,000,000	$ 982,930
2031	7,500,000	1,500,000		732,692	700,000	350,000	150,000		1,822,000	3,643,000	6,665,000	$ 2,585,239
2032	7,500,000	1,500,000		732,692	700,000	350,000	150,000		1,822,000	3,643,000	6,665,000	$ 4,187,548
2033	7,500,000	1,500,000		732,692	700,000	350,000	150,000		1,822,000	3,643,000	6,665,000	$ 5,789,857
2034	7,500,000	1,500,000		732,692	700,000	350,000	150,000		1,822,000	3,643,000	6,665,000	$ 7,392,166
2035	7,500,000	1,500,000		732,692	700,000	350,000	150,000		1,822,000	3,643,000	6,665,000	$ 8,994,475
2036	7,500,000	1,500,000		732,692	700,000	350,000	150,000		1,822,000	3,643,000	6,665,000	$ 10,596,783
2037	7,500,000	1,500,000		732,692	700,000	350,000	150,000		1,822,000	3,643,000	6,665,000	$ 12,199,092
2038	7,500,000	1,500,000		732,692	700,000	350,000	150,000		1,822,000	3,643,000	6,665,000	$ 13,801,401
2039	7,500,000	1,500,000		732,704	700,000	350,000	150,000		1,822,000	3,643,000	6,665,000	$ 15,403,698
2040	7,500,000	1,500,000		311,839	700,000	350,000	150,000		1,822,000	3,643,000	6,665,000	$ 17,426,860
2041	7,500,000	1,500,000		304,504	700,000	350,000	150,000		1,822,000	3,643,000	6,665,000	$ 19,457,357
2042	7,500,000	1,500,000		304,499	700,000	350,000	150,000		1,822,000	3,643,000	6,665,000	$ 21,487,858
2043	7,500,000	1,500,000		264,267	700,000	350,000	150,000		1,822,000	3,643,000	6,665,000	$ 23,558,592
2044	7,500,000	1,500,000		254,124	700,000	350,000	150,000		1,822,000	3,643,000	6,665,000	$ 25,639,469
2045	7,500,000	1,500,000		254,124	700,000	350,000	150,000		1,822,000	3,643,000	6,665,000	$ 27,720,346
2046	7,500,000	1,500,000		254,145	700,000	350,000	150,000		1,822,000	3,643,000	6,665,000	$ 29,801,202
2047	7,500,000	1,500,000		132,705	700,000	350,000	150,000		1,822,000	3,643,000	6,665,000	$ 32,003,498
2048	7,500,000	1,500,000		76,998	700,000	350,000	150,000		1,822,000	3,643,000	6,665,000	$ 34,261,501
Total	484,746,671	64,967,916	27,591,621	77,986,208	33,793,308	17,042,768	6,925,687	474,000	251,889,636	215,340,067		

1/ Upfront cost sharing was created but not requested by the UC Region this year. Cost Share obligations were met by funds already sitting in the UC Region account, mostly from Unliquidated Obligations in the Parallel Program.

COLORADO RIVER BASIN SALINITY CONTROL PROGRAM TITLE II

Lower Colorado River Basin Development Fund

As of 9/30/2011

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
	Repayment																		
				Grand Valley															
	Paradox Valley Unit			Construction Completed								Las Vegas	Lower Gunnison		McElmo Creek		USDA	Transfer to	
Year	Well	Facilities	O&M	Sep-89	Sep-92	Sep-93	Sep-97	Sep-98	Sep-99	Total	O&M	Wash	Construction	O&M	Construction	O&M	NRCS	Treasury	Year
1988											11,410				17,402		27,797	56,609	1988
1989			5,511								14,424				160,515		490,562	671,012	1989
1990			25,242	165,039						165,039	5,178				176,194		595,923	967,576	1990
1991			40,744	165,366						165,366	20,826		683,908		685,579		827,733	2,424,156	1991
1992			54,736	167,566						167,566	24,461		1,018,031		1,022,056	12,857	1,041,545	3,341,252	1992
1993			100,304	170,951	30,755					201,706	25,037		1,800,250	58,374	1,791,857	13,151	1,511,481	5,502,160	1993
1994			90,727	170,982	33,049	65,779				269,810	62,403	36,690	1,481,236	62,335	3,508,286	29,635	2,312,460	7,853,582	1994
1995			104,588	170,982	34,063	66,016				271,061	12,198	7,338	1,265,024	89,901	2,263,383	10,861	1,809,345	5,833,699	1995
1996			523,452	318,081	35,023	66,024				419,128	172,501	11,439	151,911	150,538	407,689	97,918	2,641,054	4,575,630	1996
1997			156,978	23,861	35,347	66,033				125,241	51,373	3,237	45,361	45,222	122,133	29,592	791,145	1,370,282	1997
1998			307,790	171,053	35,713	66,038	134,568	313,270		720,642	108,753	7,338	382,343	61,102	616,036	75,921		2,279,925	1998
1999			52,534	171,053	39,952	66,043	134,689	491,475	58,629	961,841	105,987	7,338	-256		52,823			1,180,267	1999
2000				363,811	39,254	17,978	23,822	540,162	40,109	1,025,136		7,338	1,362		1,139			1,034,975	2000
2001				365,715	39,498	18,064	24,536	512,562	64,761	1,025,136		7,338	1,362		1,139			1,034,975	2001
2002				366,384	39,540	18,152	24,053	523,997	57,847	1,029,973								1,029,973	2002
2003				363,833	41,792	17,978	23,822	523,964	53,747	1,025,136		7,338						1,032,474	2003
2004				363,890	39,275	17,978	23,822	521,838	58,333	1,025,136		7,338						1,032,474	2004
2005				363,376	39,276	17,978	23,822	521,921	58,763	1,025,136		7,338						1,032,474	2005
2006	2,655,420	1,214,010		363,376	39,276	17,978	23,822	521,921	58,763	1,025,136		7,338						4,901,904	2006
2007	264,480	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338	-383,526		166,259			779,905	2007
2008	264,480	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338			-577,579			419,593	2008
2009	264,480	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338						997,172	2009
2010	264,480	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338						997,172	2010
2011	264,480	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338						997,172	2011
Subtotal	3,977,820	1,821,015	1,462,606	6,349,569	722,918	572,834	528,596	4,658,180	835,857	13,667,954	614,551	154,098	6,447,006	467,472	10,414,911	269,935	12,049,045	51,346,413	
2012	264,480	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338						997,172	2012
2013	264,480	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338						997,172	2013
2014	264,480	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338						997,172	2014
2015	264,480	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338						997,172	2015
2016	264,480	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338						997,172	2016
2017	264,480	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338						997,172	2017
2018	264,480	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338						997,172	2018
2019	264,480	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338						997,172	2019
2020	264,480	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338						997,172	2020
2021	264,480	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338						997,172	2021
2022	264,480	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338						997,172	2022
2023	264,480	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338						997,172	2023
2024	264,480	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338						997,172	2024
2025	264,480	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338						997,172	2025
2026	264,482	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338						997,174	2026
2027	0	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338						732,692	2027
2028	0	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338						732,692	2028
2029	0	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338						732,692	2029
2030	0	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338						732,692	2030
2031	0	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338						732,692	2031
2032	0	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,336						732,692	2032
2033	0	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338						732,692	2033
2034	0	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338						732,692	2034
2035	0	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338						732,692	2035
2036	0	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338						732,692	2036
2037	0	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338						732,692	2037
2038	0	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338						732,692	2038
2039	0	121,401		420,862	40,221	10,159	18,328	37,414	76,981	603,965		7,338						732,704	2039
2040	0	121,401			40,221	10,159	18,328	37,414	76,981	183,103		7,335						311,839	2040
2041	0	121,401			40,221	10,159	18,328	37,414	76,981	183,103								304,504	2041
2042	0	121,401			40,216	10,159	18,328	37,414	76,981	183,098								304,499	2042
2043	0	121,401				10,143	18,328	37,414	76,981	142,866								264,267	2043
2044	0	121,401					18,328	37,414	76,981	132,723								254,124	2044
2045	0	121,401					18,328	37,414	76,981	132,723								254,124	2045
2046	0	121,422					18,328	37,414	76,981	132,723								254,145	2046
2047	0	0					18,330	37,394	76,981	132,705								132,705	2047
2048									76,998	76,998								76,998	2048
Total	7,945,022	6,070,071	1,462,606	18,133,381	1,969,764	897,906	1,188,406	6,005,064	3,684,171	31,878,692	614,551	366,897	6,447,006	467,472	10,414,911	269,935	12,049,045	77,986,208	

BLM Library
Denver Federal Center
Bldg. 50, OC-521
P.O. Box 25047
Denver, CO 80225

Colorado River Basin Salinity Control Program

Projected Generation and Expenditure of Cost-Share Dollars Generated on Salinity Control Activities

Source/Generation of Cost-Share Dollars

Last updated: October 20, 2011	Balance as of end FY		Balance as of end FY		Balance as of end FY		Balance as of end FY		Balance as of end FY		
Fiscal Year	**2011**		**2012**		**2013**		**2014**		**2015**		**Subtotal**
Reclamation Program	Expenditure	Cost Share	Expenditure	Cost Share	Expenditure	Cost Share	Expenditure	Cost Share	Expenditure	Cost Share	
Basinwide Program	$8,053,040	$3,451,000	$7,000,000	$3,000,000	$7,000,000	$3,000,000	$7,000,000	$3,000,000	$7,000,000	$3,000,000	
O&M	$4,593,863	$1,564,144	$3,100,000	$1,329,000	$3,100,000	$1,329,000	$3,100,000	$1,329,000	$3,100,000	$1,329,000	
BSP Funds Generated from Reclamation		$5,015,144		$4,329,000		$4,329,000		$4,329,000		$4,329,000	$22,331,144
NRCS Program											
Colorado NRCS	EQIP/TA	Cost Share	EQIP/TA	Cost Share	EQIP/TA	Cost Share	EQIP/TA	Cost Share	EQIP/TA	Cost Share	
Projected EQIP Obligations/Cost Share	**$5,248,602**	**$2,249,000**	**$4,000,000**	**$1,714,000**	**$3,800,000**	**$1,629,000**	**$3,800,000**	**$1,629,000**	**$3,800,000**	**$1,629,000**	
Projected TA Expenditures/Cost Share	**$2,699,631**	**$1,157,000**	**$2,600,000**	**$1,114,000**	**$2,400,000**	**$1,029,000**	**$2,400,000**	**$1,029,000**	**$2,400,000**	**$1,029,000**	
Utah NRCS											
Projected EQIP Obligations/Cost Share	**$6,805,151**	**$2,916,000**	**$5,500,000**	**$2,357,000**	**$5,000,000**	**$2,143,000**	**$5,000,000**	**$2,143,000**	**$5,000,000**	**$2,143,000**	
Projected TA Expenditures/Cost Share	**$2,690,000**	**$1,153,000**	**$1,900,000**	**$814,000**	**$1,700,000**	**$729,000**	**$1,700,000**	**$729,000**	**$1,700,000**	**$729,000**	
Wyoming NRCS											
Projected EQIP Obligations/Cost Share	**$145,486**	**$62,000**	**$140,000**	**$60,000**	**$140,000**	**$60,000**	**$140,000**	**$60,000**	**$140,000**	**$60,000**	
Projected TA Expenditures/Cost Share	**$61,800**	**$26,000**	**$55,000**	**$24,000**	**$55,000**	**$24,000**	**$55,000**	**$24,000**	**$55,000**	**$24,000**	
BSP Funds Generated from EQIP		$7,563,000		$6,083,000		$5,614,000		$5,614,000		$5,614,000	$30,488,000
Total BSP Generated Funds	**$12,578,144**		**$10,412,000**		**$9,943,000**		**$9,943,000**		**$9,943,000**		$52,819,144

Basin States Program - Projected Expenditures

Cost Share in Basinwide Program	$3,451,000	$3,000,000	$3,000,000	$3,000,000	$3,000,000	$15,451,000
Cost Share Adjustment for Basinwide Agreements	$400,000	$0	$0	$0	$0	
Cost Share in Reclamation O&M	$1,564,144	$1,329,000	$1,329,000	$1,329,000	$1,329,000	$6,880,144
Remaining CO Parallel Program	$1,746,297	$2,168,208				$3,914,505
Remaining UT Parallel Program	$2,271,537	$3,044,878				$5,316,415
NRCS - Colorado TA	**($696,180)**	**$651,320**	**$619,020**	**$619,020**	**$619,020**	**$1,812,200**
NRCS - Utah TA	**$2,127,120**	**$0**	**$814,340**	**$814,340**	**$814,340**	**$4,570,140**
NRCS - Wyoming TA	**$200,000**	**$200,000**	**$200,000**	**$200,000**	**$200,000**	**$1,000,000**
Reclamation TA	$104,210	$34,280	$75,440	$75,440	$75,440	$364,810
Colorado Ag. BSP	**$0**	**$2,000,000**	**$977,400**	**$977,400**	**$977,400**	**$4,932,200**
Utah Ag. BSP	**$0**	**$2,000,000**	**$1,285,800**	**$1,285,800**	**$1,285,800**	**$5,857,400**
Research and Study Projects	**$1,131,203**	**$771,200**	**$703,200**	**$703,200**	**$703,200**	**$4,012,003**
Planning and Coordination	**$320,357**	**$0**	**$0**	**$0**	**$0**	**$320,357**
Planning Studies	**$0**	**$300,000**				**$300,000**
Paradox Valley Salinity Studies	**$65,000**	**$100,000**	**$100,000**	**$100,000**	**$100,000**	**$465,000**
2010 FOA Projects	$625,000	$3,852,392	$334,907	$1,000,000	$1,399,903	$7,212,202
End of year Cost Share Adjustment FY 2011	($739,541)	$0	$0	$0	$0	($739,541)
Carryover from 2010	$22,578,246					
Total Funds Remaining Per Year	$7,997	($9,039,278)	$503,893	($161,200)	($561,103)	
Remaining BSP Funds	**$22,586,243**	**$13,546,965**	**$14,050,858**	**$13,889,658**	**$13,328,555**	

BLM Library
Denver Federal Center
Bldg. 50, OC-521
P.O. Box 25047
Denver, CO 80225